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# Using Guided Math and Flipped Learning in a Fifth Grade Fractions Unit

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# USING GUIDED MATH AND FLIPPED LEARNING

# IN A FIFTH GRADE FRACTIONS UNIT

By

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# CHAPTER ONE

## Introduction

### Overview

Mathematics is everywhere. It is a constant part of our daily lives and the decisions we make are often influenced by mathematical concepts without us even consciously realizing that we are using math. The experience we have with math during our school years is often a very vivid memory. While mine was largely positive, I know that many people feel differently about their math education and ability. I have had many parent-teacher conferences where, when sharing a students' difficulty with math, the parents inform me that they are not surprised, because they struggled with math during their own school years. Where does this attitude come from? When does this feeling begin to occur? Why does this feeling happen? I have seen in my fourth and fifth grade classes that it often stems from the students' ability to work with fraction concepts. Fractions are part of many different areas of math and I have seen and heard the negative reactions students have toward concepts involving fractions.

My goal for this research is to discover the instructional methods for mathematics that are most successful for fifth grade students and thus answer the question: *How can I design a math curriculum that will increase fifth grade students' understanding of fraction concepts?* I believe that addressing this question will help my students to develop positive attitudes toward math and in turn increase their abilities across the scope of the subject.

Throughout the following sections of this chapter, I will discuss my personal history with mathematics as a student throughout my own education; my teaching background as a professional educator, specifically related to math instruction; the methods of math instruction I have employed in my fifth grade classroom; and the various aspects of instruction I intend to research as part of my quest to discover how to create a fractions curriculum that will help improve my students' mathematics achievement.

## My Personal History with Mathematics

I grew up in a family of educators, both on my mother's and my father's side. School and learning have been part of my life for as long as I can remember. The value of education was something I never questioned. From a very young age, I was fascinated with the way my father was able to remember long strings of numbers and manipulate them in his brain. I thought it was almost magical and I can remember wanting to learn the tricks for how to do that in my brain, too. Mathematics has been a large interest of mine ever since.

As I entered my elementary school years, my passion for math began to grow and was encouraged. In first grade, we had daily challenge problems that I loved to complete. In second grade, I had the opportunity to work with a high potential teacher who would give us logic puzzles. Deciphering the clues to figure out which object matched with which person and place became something that I continue to do to this day, both with my students, and as a way to pass time on airplane rides. Later in elementary school, I participated in a program called Challenge Math and competed in Math Masters.

Challenge Math involved visual math models and puzzle solving, while Math Masters was a team-based contest with individuals competing in different math segments, such as fact fluency or problem-solving.

I was always looking for opportunities to do math outside of the classroom. In fifth grade, my teacher gave us pre-tests before each unit. If we passed, we were able to go to the library to do math on the computer. I was always striving to test out of each unit, however, as I look back as a teacher, I realize that although my confidence was incredibly high, I was not challenged to go beyond my capabilities.

In middle school, I had the opportunity to take an advanced math class for the first time. In sixth grade, I was thrilled to be learning new things again, but unfortunately I stopped loving math. I found myself still earning top grades and math was still fairly easy for me, but the amount of homework we had each night as 12-year-olds was beyond overwhelming. I was spending at least two or three hours a night on homework for a subject in which I had high skills. I cannot imagine what that year was like for students in my class who found math difficult. I felt like the point of that math class was for the students to learn as much as possible quickly so that the information could be regurgitated on a test and then forgotten as we moved on to the next concept. The instructional method used by my teacher was the “drill and kill” approach: teach an algorithm, have the students memorize the steps, and practice repeatedly until it was ingrained in the minds of the students. There was not any time for exploration, extensions, or full numerical understanding. When I reached high school, I was still finding success academically in the mathematics classroom, but I had yet to find another

teacher who sparked that desire to learn in me again. It seemed that many of the instructors I had in high school were masters of their subject, but lacked the ability to teach the content to students in a way that encouraged mathematical growth. I was learning the information because I was required to in order to pass the class, not because I was interested in learning.

It was not until college that I started feeling positively about math again. I was learning how to teach it, while also being given a second chance to learn it. As I began thinking about the teaching career I would be starting soon, I remembered all of the wonderful things about math I experienced in elementary school—activities, extensions, and challenges that forced me to look deeper at the content while also being interested in learning. I took three math courses about how to instruct mathematical concepts to students in grades Kindergarten through fifth. Each one made me think about how to instill a love for math within each child I would soon teach. I hoped that they would enjoy math as I had at that age. I could not wait to get into a classroom and let my smiling, eager students learn all about the magic of math.

## My Teaching Background

Because I was a December graduate, my first teaching job came in the spring of the following year. I was a long-term substitute in a fifth grade classroom for a teacher on paternity leave from the beginning of April through the end of the year. The best part, for me, was that I was teaching in the very building where I had attended elementary school. I could not believe my good fortune to be gaining inspiration by walking the halls of the very place that not only made me want to be a teacher, but sparked my passion for

learning and for math. My first class had 31 students and as much as I could not wait to get started with them, they felt just as strongly about their dislike for math: groaning when it was time to math, lack of participation, and avoidance behaviors were commonplace in that classroom. It was extremely difficult to motivate them because their attitude toward the subject was fully negative. Since I was joining the class three weeks before the Minnesota Comprehensive Assessments (MCAs), I realized quickly that it was my duty to the regular teacher of that classroom to ensure those students were prepared for the tests. This trumped my desire to change their outlook about their math abilities.

After spending the next school year in two different long-term substitute positions, I finally had the chance to have my own classroom for an entire school year. During the summer, I prepared index cards with all of the important vocabulary words for an entire year's worth of math units, handwritten in colored block-letters to correspond with each unit. I hung them meticulously all over the room, hoping that if my fourth graders saw this vocabulary every day, they would realize the importance of the words.

I taught math to my homeroom students, making my math class a heterogeneous group in terms of ability. I taught my lessons whole group with time for students to practice the concepts on their own each day. During that independent time, I went around the room to assist students as needed or as I was able. I experienced varied success with this method, and discovered that many students were unable to perform at grade level on the MCA and many continued to feel negatively toward math because they found it too difficult.

Since that year, I have taught four more full years and am currently in the midst of my fifth. As I have continued to try different methods of instruction in the various grade levels I have taught, I have noticed that the single most difficult unit for students to grasp involves fractions. Their negative attitudes about fractional concepts spill over into working with remainders in division, decimals, and ordering numbers from sets involving numbers that are not whole. Ironically, fractions are the tenet of math that I see them using most often in their daily interactions with each other: from dividing up materials, to sharing snacks, to determining the amount of time someone gets to sit in a certain special place in the classroom. This realization has inspired me to discover the most effective way to teach fifth grade students fractions—a vital concept for them to master and feel confident about before moving on to middle school.

Mathematics Instruction in my Classroom

My district adopted a curriculum called *Bridges in Mathematics* five years ago, but quickly discovered it to be lacking compared to other curricula. Currently, the message from the district is that *Bridges* is just one of the many resources we have to teach math, and our curriculum is really the Minnesota state math standards. Thus, math instruction looks very different from grade to grade and building to building throughout the eighteen elementary schools in my district.

I have taught at three different elementary schools in my current district. During the 2014-2015 school year, I taught at a building where there were three sections of fifth grade, with a total of 75 students. Our district has an advanced curriculum called "$M^3$" that requires students meet a variety of criteria in order to participate in this special class.

Last year, we had 33 students qualify for $M^3$, which allowed the remaining two teachers to have just 21 students in each of the regular math classes, of which I taught one of those classes. We had permission at the building level to supplement the curriculum where we see fit, so our principal allowed us to order pieces of the *Math Expressions* curriculum. We used this as a foundation for organizing our units, but since we only had part of the materials, we tended to teach from the homework, meaning we constructed our learning objectives from the homework of that day. We usually conducted whole-group instruction and found various resources online to assist with teaching the lessons.

We really struggled sometimes with identifying the best methods of instruction and how to find the materials to help us teach. I have used short videos to introduce concepts and I have also focused on vocabulary. I required students to keep math notebooks where they practice concepts and take notes on procedures so that they had definitions and examples at their fingertips when completing their own practice. Additionally, we assigned at-home online work on the site IXL.com to boost mathematics fluency. Sometimes, I would group my students by ability and have them go through stations, one of which was a mini-lesson with me. I do not feel that I ever found the most effective way to teach math, as I often changed methods multiple times throughout the year.

Having taught for three years in fifth grade, which amounts to half of my teaching career, I now feel that I have a solid grasp on exactly what students need in order to achieve proficiency and meet the Minnesota math standards. Nevertheless, students in my district consistently perform lower on questions involving fractions than in other areas.

Unfortunately, I have yet to discover the best way to instruct my students in fractions. I hope, though, that through this project, I will be able to find the most effective instructional strategies for math.

The Research Question

As I previously discussed, I have pinpointed fractions as the part of math that my students dislike the most, and thus affects their overall achievement in mastering fifth grade math concepts. Thus I have selected as my research question: *How can I design a math curriculum that will increase fifth grade students' understanding of fraction concepts?* In order to discover the instructional methods best suited for teaching fractions, I will assume that whole-group instruction to a class of heterogeneous abilities is the norm. Throughout this paper I will investigate other possible methods of instruction, such as ability-grouping, differentiation, guided mathematics, and flipped learning. As a teacher, I cannot stray from the expectations of the content in the state standards, but I can determine the most effective ways to deliver that content to my students. In this project, I will investigate research outlining the benefits and drawbacks of the four instructional methods mentioned above.

Ability-grouping. My previous school used a modified ability-grouping instructional method for math. We had one math class for the highest-ability students in fifth grade, while the other two fifth-grade math classes were mixed-ability. True ability-grouping would involve grouping the students in the two mixed-ability math classes into an average group and a below-average group. Ideally, the below-average group would have smaller numbers so that the teacher could clearly target each students' needs, but the

number of students in each group would depend upon the students' math abilities as a whole.

Differentiation. This method is used by teachers across all subject areas in the classroom. Differentiation in math allows for students to learn the same concepts together, while completing them at their own level. Teachers adapt the content to meet the needs of their students. For example, each week in my fifth grade classroom, students had four higher-level-thinking word problems to complete at home. For each problem, there are three options for the numbers they can choose to fill in. The concepts are the same for each child, but the computation ranges from easy to challenging, depending upon which set of numbers they pick.

Guided mathematics. Sammons defines guided math as "a method of teaching in which teachers assess their students formally or informally, and then group them according to their proficiencies at a given skill. The groups are homogeneous, yet fluid, as individual students' levels of understanding change" (2009, p. 21). While whole-group instruction to begin a math lesson is an option, it is not required. When students are not meeting with the teacher, they are participating in other math activities such as skill work, computer programs, or partner games.

Flipped classroom. According to the Flipped Learning Network, "flipped learning occurs when direct instruction is moved from the group teaching space to the individual learning environment" (2014, p. 1). In this method, students watch short instructional videos outside of class, while class time is utilized for individual conferring on progress and small group learning.

Summary of the Chapter

Throughout this chapter, I outlined my history with mathematics, both as a student and now as a teacher. I introduced my thinking that not only are fraction difficult for students to master, but also that these difficulties cause negative attitudes when learning other mathematics content. In the following chapters I will investigate how I can design a math curriculum that will increase fifth grade students' understanding of fraction concepts. I will do this by researching various forms of mathematics instruction and creating a fractions unit based on the results of that research to implement in a future school year.

Next, in chapter two, I will investigate the research about how elementary students learn fractions. I will discuss what teachers can do to assist students in gaining a stronger understanding of fractions. Additionally, I will look at the research surrounding best instructional practices, and consider the positive and negative impacts of utilizing ability grouping, differentiation, flipped learning, and guided math in helping elementary students learn fractions.

# CHAPTER TWO

## Literature Review

### Overview

This chapter discusses literature that answers the question, *How can I design a math curriculum that will increase fifth grade students' understanding of fraction concepts?* First, I will investigate how integral fractional knowledge is for success in fifth grade mathematics. I will discuss the barriers students face when learning fractions and what strategies are recommended for overcoming these difficulties. Next, I will consider the advantages and disadvantages of four possible instructional strategies: ability grouping, differentiation, flipped learning, and guided math. Are certain instructional strategies more beneficial for specific groups of students? Is there one instructional strategy that is best suited for increasing mathematical proficiency? Finally, I will present my synthesis of the literature to determine what instructional strategies will best meet the needs of my students for the purposes of this curriculum.

### Fractions and State Standards

In order to create a curriculum that increases student proficiency with fractions, one must first investigate the barriers to students' achievement in this area. According to the 2007 Minnesota mathematics standards (the most recent implementation of math standards), fifth grade students are expected to be proficient in various fraction concepts in eight of the thirteen Numbers and Operations standards. The 2014 test specifications for the fifth grade math Minnesota Comprehensive Assessment (MCA) stated that the Numbers and Operation strand of standards make up 41% of the test questions, with the

next highest strand, Algebra, making up just 25% of the questions. Within the Numbers and Operations section, questions including fraction content comprise at least 57%, making fraction questions almost equal to the entire Algebra strand. With such a large part of fifth grade math proficiency hinging on students' ability to demonstrate achievement in fraction concepts, it is no wonder that student performance in this area often determines whether or not a student earns a score that meets the standard on the MCA.

Barriers to students' learning. According to Osana and Pitsolantis (2011), one of the largest struggles for students learning fractions is their lack of ability to connect concepts and procedures. Usually, as with many mathematical concepts, students learn a basic algorithm for computation, but cannot transfer that knowledge to problems that do not fit within the realm of said algorithm. Students can often demonstrate proficiency within the confines of skill worksheets, but when asked to explain the reasoning behind the method, students often are unable to do so successfully. This missing connection also can restrict students from transferring their fraction knowledge to real world problems. Chick, Tierney, and Storeygard (2007) also discussed how teachers can sometimes be fooled by the performance of students who master procedural content.

Osana and Pitsolantis (2011) cited the findings of Moss and Case (1999) and Mack (1995) to further discuss reasons why students have difficulty with learning fraction concepts. Moss and Case believed that teachers were not spending enough time ensuring that students understood, for example, not just how to add or subtract fractions, but why the process of doing so is correct. Mack found that for many students, the way

they learned to manipulate whole numbers interfered with their abilities to understand such manipulation with fractional numbers. Gearhart et. al (1999) suggested that lack of professional development support for teachers hinders the ability of teachers to adequately develop students' foundational knowledge of fraction concepts. Another hurdle to students' success with fractions stems from the vocabulary that is unique to fraction work (Chick, Tierney & Storeygard, 2007). The lack of ability students have with remembering vocabulary terms demonstrates the deeper issue that students actually do not understand the meaning behind the words. All of these issues contribute to students not having success when learning about fractions.

Strategies for increasing students' fraction proficiency. To remedy the struggles students face when learning fractions, there are many options for teachers to explore. Osana and Pitsolantis (2011) suggested that teachers focus on making explicit connections between the mathematical symbols used with fractions and their exact meaning. For example, some students do not realize that the fraction bar between the numerator and denominator is actually another symbol for division. Students cannot be expected to make such connections on their own. Additionally, an emphasis on vocabulary instruction is key to ensuring that students do not learn just the procedures, but the concepts behind the procedures (Chick, Tierney & Storeygard, 2007). Having one-on-one or small group conversations with students while they solve procedural problems allow teachers to probe students' foundational knowledge of fractions. These discussions will identify for teachers the students who are lacking conceptual knowledge, procedural knowledge, or both (Chick, Tierney, & Storeygard, 2007).

Gearhart et al. (1999) urged that teachers, both veteran and preservice, spend time dissecting curricula and recording whole class lessons in discussions with other teachers to pinpoint the "opportunities to learn" (p. 310) that are present in their own classrooms. Opportunities to learn are vital to student success and include three main ideas: "classroom practices [that] elicit and build upon students' thinking,...conceptual issues [being] addressed in treatments of problem solving, and...students' opportunities to utilize and interpret numeric representations in ways that may help them build understandings of mathematical concepts" (p. 293). All of those ideas are related to the importance of connecting fractions to the real-world. As the above recommendations suggest, it is crucial to create a curriculum that will help students fully grasp the content.

Next, one must consider what specific instructional strategies are best suited to teach student proficiency in fractions. There are many options for instructional strategies in an elementary classroom. Ability grouping, differentiation, flipped learning, and guided math all provide different options that have both benefits and drawbacks.

## Ability Grouping

One option that teachers may consider when developing an instructional plan for mathematics is the use of ability grouping. Ability grouping is often a controversial method of instruction due to the perceived effect it can have on a student's self-esteem. This is compounded when combined with the effect of the difficulty students face in learning fractions. However, proponents of ability grouping believe there are real benefits to this method of instruction: High-achieving students have the opportunity to be

challenged, while students who are struggling to perform well in math get targeted instruction with a smaller group of students.

Advantages of ability grouping. Vann (1999) discussed that in schools lacking enrichment opportunities or gifted and talented programs, ability grouping can allow for the top-performing math students to be challenged in a way that may not happen in a heterogeneous math class. Students in a high-ability class learn at an accelerated pace and a deeper level than if they were mixed in a classroom with students who are at- or below-grade level performance. There are benefits for both teachers and students when teachers choose to ability group. Vann (1999) stated:

> For the teachers, it's an opportunity to work with different children and focus their skills at one broad level. For the students, it's an opportunity to release energy as they move to another classroom, to socialize with different peers, and to learn from an instructor whose teaching style may be more compatible with their own learning styles. (p. 59)

When viewing ability grouping with this lens, its use may lead to more engagement.

At the fifth grade level, where students are often in their final year before moving on to a middle school, parents often advocate for their children to have advanced learning opportunities due to the courses offered at the middle school level. If students do not have the chance for enrichment in elementary school, they may not meet the requirements necessary to take a higher-level math class in middle school. This, in turn, may affect those students' chances at being admitted into accelerated high school classes.

Disadvantages of ability grouping. The nature of the elementary school day is defined by scheduling, specifically by lunch, recess, and specialist class periods. By using ability grouping, teachers are adding one more restriction to their already rigid day (Vann, 1999). This limits the opportunities for teachers to extend a math lesson outside of the math time or use other times of the day for remediation—both of which can be done when students stay with their homeroom teacher for the duration of the school day in a heterogeneous class (Vann, 1999). Additionally, Boaler (2008) suggested that using mixed-ability math classes could have extra benefits for students that extend beyond the mathematics curriculum. Boaler (2008) said, in regards to a study completed at Railside School where mixed-ability math classes were the norm:

> The students learned in their mathematics classrooms that they could solve complex problems through persistence and collaboration with others. They learned to value the different and varied ways in which different people solved problems. They learned to respect students from different ethnicities, genders, and social classes and they learned effective methods of communication (p. 190).

Boaler (2008) believed that learning is a social process, where students discussing ideas and processes with each other further increases the students' learning. If students are only learning with other students of similar-ability, they miss out on the opportunities to learn from the thoughts and processes of those who are at different levels; thus, students cannot learn in other ways than they have always learned themselves (Boaler, 2008).

Another significant drawback to ability-grouping is the impact such grouping may have on a student's mindset. Howard and Whitaker (2011) cited a survey of students who

suggested that mathematics is the subject where a fixed mindset and lack of confidence had the strongest negative effect on achievement. When students believe that they cannot do math and that math is too difficult, their achievement levels are often slow to progress. As Yeager and Dweck (2012) stated, "two of the most important issues currently facing educators...are academic underachievement and...the impact of peer exclusion and victimization" (p. 302). Ability grouping is, in essence, telling a child how successful they are in mathematics, because the class they are assigned to is based on their ability level. This can be extremely difficult for children to reconcile when placed in a lower-ability group, because it is a direct message from their teacher that they are not as good at math as some of their peers. In a subject where so much of student progress is based on a student's comfort level and confidence, the benefits of ability-grouping for the lower-achieving students may not outweigh the deficiencies. However, there may be a better option for all groups of students.

Differentiation

Differentiation is a common practice in classrooms across the grade levels. According to Tomlinson (2003), "Differentiation is really just common sense...Differentiated teaching is responsive teaching. It stems from a teacher's solid...understanding of how teaching and learning occur, and it responds to varied learners' needs" (p. 1-2). Differentiation in math allows for students to learn the same concepts together, while completing them at their level and in various ways. As Ensign (2012) wrote, the purpose of differentiation in math instruction is to support every student "in progressing from his or her present level of understanding to a much higher level" (p.

158). Since differentiation is a common practice in elementary classrooms, there are many different methods of implementation. With a concept such as fractions, where student abilities within the topic can be wide-ranging, it is important to consider creating a curriculum that begins by addressing individual student needs.

Differentiation as the basic structure for mathematics curriculum. Tomlinson (2003) utilized differentiation as a means of designing a mathematics curriculum by creating a three-to-four week geometry unit. Any curriculum must first begin with a study of the academic standards to gain a comprehensive understanding of what are the expected proficiencies of at-grade level students for each concept. At the onset of implementation, Tomlinson (2003) began by giving students a "Geometry Knowledge Rating Scale" (p. 101) as a unit pre-assessment to help determine flexible instructional groups and determine appropriate end-of-unit performance for each student. Each lesson throughout a differentiation unit must include components where differentiation can be identified. Additionally, this must include an end-of-unit assessment. While pre-assessment can determine differentiation based on readiness for a particular concept, end-of-unit assessment must also address learning style differentiation (Tomlinson, 2003). In this particular unit, positive results were seen as Tomlinson (2003) considered a dual layer of differentiation in order to best meet the needs of the students and to get a full picture of their abilities and achievement on the geometry objectives.

Possible components of differentiated instruction in an elementary math classroom. Ensign (2012) cited the work of one upper elementary math teacher at Leschi Elementary in Seattle who implemented a differentiation model. In this model, the

teacher has a 75-minute block of instructional time. Each day begins with a 15-minute introductory lesson where the main ideas and vocabulary for the day are presented. Next, students rotate through three different stations in ability groups: on level, above level, and below level. Each group spends one rotation with the teacher, beginning with the lowest group, through the highest. During the other two rotations where students are not with their teacher, students completed independent practice work and had time at the games station. Following the three rotations, the class completed an exit slip demonstrating their ability to perform a task on the stated objective of the day. Upon completion of the exit slip, students self-assessed their ability to do what was asked. This additional piece allowed for the teacher to gain insight into the students' confidence levels and how they rated their performance (Ensign, 2012).

The effects of differentiation on students in the classroom. According to Maggio and Sayler (2013), the highest ability math students are among those most under-served in the traditional mathematics model of instruction. Students at the top end of their class need acceleration and enrichment opportunities. In differentiation, acceleration allows for strong math students to move through the grade level standards at a faster pace than their classmates. In one fifth grade example of acceleration, students completed the fifth grade level mathematics standards and moved onto sixth grade level mathematics standards in the course of one school year (Maggio & Sayler, 2013).

The lowest-performing students in a mathematics classroom benefit from differentiation because the groups are constantly changing. Students have the opportunity to learn what and how they do best, depending on the content being covered. Students do

not necessarily need to stay in a low-performing group throughout the year, which can provide motivation and affirmation that they need in a subject such as math.

Differentiation is a successful classroom instructional practice when also paired with enhancing techniques. O'Donnell (2009) studied four elementary math classrooms and the instructional strategies used in accordance with differentiation. O'Donnell then suggested that teachers employ such techniques as allowing students to lead mathematical discussions, hold students responsible for their learning while simultaneously having high expectations, and fostering critical thinking skills by utilizing challenging example problems.

Differentiation is an instructional strategy that allows for a lot of flexibility to meet the needs of various learners. It is also an open-ended technique that can be utilized across subject areas. This may make differentiation less appealing to a teacher trying to find more specific ways to best meet the needs of the students. Flipped learning may better meet the need of teachers seeking more targeted instructional strategies for conveying fraction content.

Flipped Learning

According to the Flipped Learning Network, "flipped learning occurs when direct instruction is moved from the group teaching space to the individual learning environment" (2014). In this method, students watch short instructional videos outside of class, while class time is utilized for individual conferring on progress and small group learning. Herreid and Schiller (2013) further described flipped learning as "what is normally done in class and what is normally done as homework is switched or flipped"

(p. 62). The rationale behind this method of instruction is that typical homework from a math classroom is better done in the classroom with a teacher, to help immediately alleviate any problems or misconceptions. To ensure there is enough time in class to teach this way, students are required to learn about a concept before coming to class (Herreid & Schiller, 2013). A flipped classroom may provide exactly what students need in a curriculum on fractions because it allows for models and demonstrations that can be re-watched as often as necessary about a topic that is more easily understood visually than orally.

Benefits of teaching and learning in a flipped classroom. Technology is an integral part of today's society. Children begin using technology at a very early age and schools today are struggling to keep up with the latest advancements (DeFour, 2013). Flipped learning makes it easy for students to utilize tools that they are very comfortable with for an academic purpose. Thus, these students can watch a teacher explain mathematics in a short video, where the teacher visually demonstrates how to solve a problem in a medium that allows students to take notes, pause, and re-watch the content as necessary (DeFour, 2013). Parents and family members can also view these videos to assist students at home.

In-class time can be used for individual coaching, peer work, and small group assistance. By pre-learning the content, students are tuning their brains to the information that will be further discussed in class the following day. This model of instruction affords teachers the opportunity to spend more time in the classroom with students who are having difficulty learning the content. It also allows advanced students to move through

the material more quickly, and fosters higher student engagement with the content than the traditional method of in-class lessons (Tucker, 2012).

Teachers have found creating flipped lessons actually improves their practice. Tucker (2012) suggests that putting together short instructional videos forces teachers to pinpoint the exact concepts vital to a particular standard and consider how best to convey that information. This allows teachers to construct the "pace, the examples used, [and] the visual representation" (Tucker, 2012) in a manner that best fits the student population. Perhaps most importantly, Tucker (2012) cited a teacher who found the biggest benefit of flipped learning to be the ability to "more easily query individual students, probe for misconceptions around [mathematical] concepts, and clear up incorrect notions" (p. 82). Herreid and Schiller (2013) further described the benefits of teaching in a flipped classroom:

> Teachers have forever struggled to get students to study on their own, either ahead of time or as homework; that is when the real learning happens, not when the teacher is lecturing...The flipped classroom, with its use of videos that engage and focus student learning, offers us a new model for case study teaching, combining active, student-centered learning with content mastery that can be applied to solving real-world problems (p. 65).

The use of flipped learning has real benefits for both the teacher and the students.

Drawbacks to teaching and learning in a flipped classroom. In order for the flipped classroom to be successful, all students must have access to technology in their homes. While technology has continued to become more readily available, it is still an

equity issue (Herreid & Schiller, 2013). Schools must ensure that all students in flipped classrooms have adequate devices to access the course content, while also providing instructors with the necessary tools to create the content to be delivered to the devices. Initially, creating the content for flipped classroom lectures is extremely time-consuming for teachers, which may cause some resistance to this type of instruction (DeFour, 2013). However, once created, these videos can be reused year after year.

Herreid and Schiller (2013) further detailed the two greatest difficulties with utilizing this method of instruction, according to a survey they conducted of flipped classroom teachers. First, students have learned to expect throughout their scholastic careers that they will learn in a certain way. They may be reluctant to attempt this new approach, and therefore may not complete the work outside of class necessary to be prepared for in-class sessions. Second, the amount of content currently available for teachers to use for students' homework is minimal. "The quality of the teacher-created videos is often marginal...and creating them requires a significant amount of time" (p. 63). Because of the large usage of teacher time and the frequent struggle necessary to convince students to learn this way, teachers may decide it is not worth the benefits to use this model of instruction.

In a district where access to technology for use at home is provided to every student this may be an option worth exploring. Utilizing this method in a modified way, where new videos are not required daily, may make sense for a teacher trying to boost mathematical achievement for fifth graders. This is an engaging strategy that can be paired with another instructional method, such as guided math.

## Guided Math

Sammons defines guided math as "a method of teaching in which teachers assess their students formally or informally, and then group them according to their proficiencies at a given skill. The groups are homogeneous, yet fluid, as individual students' levels of understanding change" (2009, p. 21). When students are not meeting with the teacher, they are participating in other math activities such as skill work, computer programs, or partner games. Guided math was modeled after the ideas found in guided reading as described by Fountas and Pinnell (2013). The goal is to give small group instruction to students at their instructional level of learning. When considering how to best design a math curriculum on fractions, it is vital to meet students where they are at in terms of their current knowledge and achievement level.

Components of guided math instruction. According to Sammons (2009), there are seven components to guided math. In order to begin a classroom based in guided math practices, teachers must first create a "classroom environment of numeracy" (p. 18). This concept requires teachers to develop a community of learners who can see the value and importance of mathematical problem-solving in everyday activities. Teachers allow students to participate in social conversations about real-world math problems and continue to build upon previously acquired knowledge. Number-rich classrooms also immerse students in opportunities to tackle questions using higher-level thinking strategies throughout the school day.

At the beginning of math periods within guided math classrooms, students next participate in a math warm-up and whole class instruction. Guided math includes a very

structured set of routines. Students begin the math class by completing pre-assigned tasks individually, such as a daily or weekly math problem and record their thoughts and strategies in their math journals or notebooks. As a follow-up to individual work time, math warm-up continues with whole class conversation surrounding the daily calendar (Sammons, 2009). Whole class instruction, while seemingly similar to the more traditional methods of math instruction, actually allows for a lot of teacher-flexibility in the guided math classroom. The whole group instruction time can be used for "presenting activating strategies...literature connections…[or] ongoing review of mastered concepts" (Sammons, 2009, p. 20). Whole group instruction sets up the rest of the math period for the day or for the week and should be kept short. These are mini-lessons instead of the bulk of the instruction as in traditional math classes, where lectures are the focal point.

The next two components are the trademark of guided math classrooms: small group instruction and math workshop (Sammons, 2009). Small group instruction requires teachers to assess students and group them homogeneously in terms of mathematical ability. Teachers set a schedule based on a group's need for frequency and duration of instructional time. The small group instruction time is used to target the needs of each group and give precise instruction at that group's particular level. Students performing below grade level receive mediation, while students performing above grade level receive enrichment opportunities (Sammons, 2009).

During these group sessions, the heart of the mathematics instruction is delivered. While the teacher is engaged in small group instruction, the rest of the class must be occupied. These students participate in independent math workshop. At the start of the

year, teachers and students spend a lot of time developing procedures and processes for this independent work time so that the small group instruction time is not interrupted by the constant need to redirect other students and materials. Once the math workshop is up and running, "workshop tasks might [include] inquiries or investigations, math-center activities, math games, problems of the week, math journal writing, or written practice to maintain previously learned skills" (Sammons, 2009, p. 23). These activities are described for the students during the whole-class mini lesson at the start of each week or at the start of each day.

The final two components of guided math are one-on-one student/teacher conferences and continuous assessment. Individual conferences allows teachers to delve deeper into concepts with students or probe them for more information regarding their thinking processes. This often takes place during the math warm-up, or in place of small group instruction. Continuous assessment is the most vital part of ensuring that guided math instruction is successful. Instructional groups are formed as a result of assessments, and should be adjusted as the class moves from concept to concept. Fountas and Pinnell (2013) believed that instructional groups must continually evolve and change. Teachers who do not have a "systematic ongoing assessment system...to check...informal observations with what students demonstrate" (p. 275) struggle to reform groups and become overwhelmed by the seeming enormity of the guided math model. As Sammons wrote in 2009:

> A balanced system of assessment gives teachers a complete picture of each child's understanding, not just a single glimpse from a test. Formative and summative

> assessments, including observations of students' work, discussions with students, and assessment of their finished products, all give valuable perspectives on their capabilities and needs (p. 24).

Additionally, especially in the intermediate grades, students should be able to become involved in the assessment of their own abilities. By incorporating such skills as learning to use rubrics, checklists, and comparing their own work to grade level examples, students will take more ownership in their work and strive to improve their mathematical abilities (Sammons, 2009).

Advantages to guided math instruction. Guided math has many advantages for students and teachers. First, by utilizing guided math, teachers no longer need to group students by ability across a grade level. This means that teachers can return to math instruction at any time throughout the day for individual conferring or even some small group instruction because their math class is their homeroom class. Guided math also allows for flexibility within its structure. Sammons (2009) suggested multiple ways to organize the instructional block, including daily versus weekly whole group mini-lessons, varied daily routines, and several options for activities during the workshop time. In this way, guided math can be fully structured to meet the needs of a particular teacher and group of students. Students have the opportunity to learn in conversations with their whole class, or in focused instructional time with their teacher, or in small groups of similar-ability students, or in individual practice during the workshop.

Kroesbergen and Van Luit (2002) conducted a study of elementary math students in the Netherlands which discovered that students learn concrete mathematical skills,

such as multiplication, more successfully with guided math instruction than other types of instruction. Within these guided math lessons, students and teachers take part in an introduction, group practice, and individual practice. A lot of time is spent discussing possible ways to solve mathematical problems, which allows the teachers to gain insight into students' understanding, and for students to develop a stronger understanding of ways to approach various mathematical situations. This specifically is beneficial when teaching fractions, since one barrier for students is applying their skills to other types of problems.

Disadvantages to small group instruction. Guided math instruction provides many positive contributions to student learning; however, there are some drawbacks. Teachers who employ this type of instruction must be very organized. In a traditional model of mathematics instruction, teachers typically must prepare one lesson for the whole class for each math period. Guided math requires that teacher prepare multiple lessons and materials each day—whole group, small group, and individual. Teachers must also have a well-developed system of assessment and a way to filter through the data quickly in order to create targeted lessons and instructional groups. Familiarization with the needs of students and the requirements of the standards are also necessary in this teaching model. More pre-planning and development of materials are needed in this model, but according to Sammons (2009), the work at the onset can allow students and teachers to have a successful mathematics experience.

Conclusion of Instructional Strategies

Ability-grouping, differentiation, flipped classroom, and guided math all provide strong instructional options for teachers. Each one lends strong reasons toward use: some are more geared toward meeting the needs of the highest-achieving students, while others trend more toward benefitting those students who need remediation. Teachers must utilize instructional strategies that best meet the needs of all students, so that each child continues to grow in mathematical ability.

After carefully considering many instructional options for answering the research question *How can I design a math curriculum that will increase fifth grade students' understanding of fraction concepts?,* I have decided to create a fractions curriculum that employs a hybrid approach to mathematics instruction. This hybrid approach will utilize the ideals of both flipped learning and guided math. As my district moves into an era where all students in fourth grade through twelfth grade will soon have their own district-issued iPad minis for use at home and school, flipped learning is a natural way to integrate this technology into the classroom and home environment. Additionally, using the in-class strategy of guided math will be a seamless transition, due to the way literacy is currently taught to elementary classes in my district. Guided math is based on the principles of guided reading from Fountas and Pinnell, which is what I currently use in my reading instruction. Therefore, the routines and procedures will already be familiar to my students. I believe that the mix of these two strategies will best benefit my students and boost their achievement with fraction concepts.

Summary of the Chapter

Fractions comprise the largest portion of the mathematics standards for fifth graders in Minnesota. Thus, a strong foundational knowledge of fractional concepts is vital to help fifth grade students achieve mathematical success. In turn, students will experience greater success as mathematical concepts based on fractions become more difficult in middle and high school. Upon review of the literature of instructional strategies, I have decided to include portions of guided math and flipped learning in my fifth grade math curriculum. My goal is to address the barriers I discovered from the literature that hinder students from reaching their full potential when learning about fraction concepts.

Next, I will outline the methods to creating this curriculum, including the research paradigm, the participants and setting, and the procedures. Within the procedures, I will discuss the curriculum model and design.

# CHAPTER THREE

## Methods

### Overview

This chapter will outline and discuss how I will utilize the research from chapter two to answer the question, *How can I design a math curriculum that will increase fifth grade students' understanding of fraction concepts?* My rationale for selecting this as my project relates to the results of a recent study performed on my district by an outside consultant to evaluate our current math program. The consultant determined that students across our district underperform on fractions questions on standardized testing when compared to other math concepts. Additionally, I chose to create a curriculum because of the lack of math training that teachers in my district have received in recent years, since the implementation of the *Bridges* curriculum. Professional development dollars have been spent on the implementation of the Literacy Collaborative initiative, which last year alone required elementary teachers in our district to have forty hours of training in this area. There are district trainers for math who have attempted to make a timeline of what topics should be covered during each of the three trimesters, but the execution, instructional methods, and materials all vary greatly throughout the 18 elementary schools in the district. In order to create more cohesion within the district, where intra-district transfers of students are common, I believe it is important to have a curriculum that ensures students at every elementary school receive the same content.

As stated previously, fifth grade students are expected to be proficient in various fraction concepts in eight of the thirteen Numbers and Operations standards, which is the

heaviest concentration for any math concept covered in fifth grade. Therefore, a curriculum developed with a sole focus on fractions can provide the foundation for successful academic achievement in a fifth grade mathematics classroom.

In the sections that follow, I will describe the research supporting the instructional strategies I have chosen for the curriculum, the participants and setting for the curriculum, and the model I will use for creating the curriculum.

## Research Paradigm

Curriculum design for a fifth grade math unit on fractions is the basis for my project. In addition to the fact that the students in my district struggle to perform well on standardized tests with fraction concepts, I have observed in my own classroom the difficulties students face when learning about fractions. Based on classroom conversations and interactions between students, students believe that fractions are difficult to understand, and by the time they reach fifth grade, after having worked with fractions for two years prior, they have determined for themselves that fractions are a weak area of their mathematical knowledge base. Fifth grade students seem to enter my classroom with a lack of foundational skills to truly grasp fractional concepts. Fluency with number sense and basic multiplication or division facts are two areas in particular that students seem to be missing. The goal of this curriculum is to create a unit that will reverse these notions and give my future students the necessary tools and knowledge base to successfully understand fractions before entering middle school.

There are specific instructional strategies that will ground this curriculum. After studying the benefits and drawbacks to ability grouping, differentiation, flipped learning,

and guided math, I have decided to use a hybrid approach in this curriculum, where I will incorporate both flipped learning and guided math. Because of the upcoming technology initiative in my district where every fifth grade student will have their own iPad mini for use at home and school, as well as the current use of guided reading in our literacy curriculum where the ideals of guided math were founded, these two instructional strategies seemed to be the most effective choices for this curriculum. However, in a district where technology is not as readily available, or where students are not as familiar with the routines and procedures of an instructional practice like guided reading, another instructional strategy may be more beneficial.

This curriculum will utilize both guided math and flipped learning ideals. Applying the guided math instructional strategy will allow my students to receive small group instruction with similar-ability peers. As Sammons (2012) stated, "Guided math can provide a structured, practical way to teach differentiated math using small-group instruction, problem solving, and idea sharing while also encouraging students to be confident, deep thinkers" (p. 4). Flipped learning, as discussed by Tucker (2012), offers a method of learning for students that utilizes the tools of this information and technology age. In flipped learning, students watch instructional videos and take notes on concepts at home, so that direct practice can be completed with the aid of a teacher in class. By incorporating these two instructional methods as the framework of the curriculum, I believe that the understanding of fractional concepts for fifth grade students will greatly increase.

Participants and Setting

This curriculum will be designed for fifth grade students in the state of Minnesota. Specifically, this curriculum is intended for future implementation in a large suburban school district where the students are 68% Caucasian, 13% Black, 10% Asian, 8% Hispanic, and 1% American Indian. 23% of the students are eligible for free or reduced-price meals. Additionally, 6% of the students are English-learners, while 16% qualify for special education services. Fifth grade students in this district are in their final year of elementary school before moving to middle school as sixth graders. By 2017, all fifth graders in this district will have an iPad mini provided to them by the district for academic use both at school and at home. Incorporating flipped learning into my curriculum means access to technology will be vital for my participants. However, any technology that allows for students to view and listen to recorded instructional content via the internet would be suitable for use with this curriculum. Currently, fifth grade students at most elementary schools in the district participate in math classes that use modified ability grouping as the major instructional strategy. The highest performing students get pulled into one math class, while the other classes are mixed ability with the remaining students.

Procedures

There are many models and methods of curriculum design. In the area of mathematics, teachers are often bound by the requirements of their school district in terms of the published curriculum the district has bought for implementation. In my district, there is a curriculum that has been bought for use by classroom teachers, but we

are not required to use it. This curriculum is merely one of the many resources we have to teach what our district actually considers to be our curriculum—the Minnesota Academic Standards. The open-endedness of the many resources available to teachers in my district can be daunting, but it also gives us the flexibility to best meet the needs of our students. So often, teachers, in districts where the purchased curriculum is required, simply pick up the teacher's manual and directly instruct from that book, assuming that the curriculum will meet the needs of the state standards. The freedom the teachers in my district are allowed requires much more preparation, but it also forces teachers to be fully immersed in the standards. There is a deeper understanding when teachers design their own units and tailor instruction to each particular group of students. This usually results in higher-quality mathematics instruction. In the curriculum I am designing, teachers will have flexibility in the way they use their small group instructional time during guided math, while still implementing the rest of the curriculum I have designed.

Curriculum design in mathematics can get caught up in covering the material quickly due to the pressures of standardized testing, but covering the material deeply to expand student proficiency is far more important. Each year, students' knowledge continues to build on what they have previously learned in math. Utilizing assessment and determining the best instructional strategies are the keys to creating a successful math curriculum that helps increase student knowledge of fraction concepts.

Curriculum model. The creation of this curriculum will follow the Understanding by Design model (UbD). Wiggins and McTighe (2005) described UbD as, "an approach to curriculum and instruction designed to engage students in inquiry, promote transfer of

learning, provide a conceptual framework for helping students make sense of discrete facts and skills, and uncover the big ideas of content" (p. 4). The premise for UbD is that teachers begin curriculum planning from the results they wish their students to achieve, not how they want to instruct. The three stages of curriculum design using UbD are "identify desired results," "determine acceptable evidence," and "plan learning experiences and instruction" (Wiggins & McTighe, 2005). This means I will start by identifying what I want my students to achieve by the end of the unit, then consider what evidence I will gather to determine whether my students achieved those results, and finally I will plan what the lessons and activities will consist of each day. Wiggins and McTighe (2005) offer six possible points of entry for beginning the curriculum design. For the purposes of this project, my point of entry will be beginning with the 2007 Minnesota Academic Standards for Mathematics.

Curriculum design. This fifth grade math curriculum will have five weeks' worth of lessons and activities that are 60-75 minutes in length daily. However, the duration of the unit could be modified, depending on the needs of the class. The format of each lesson will loosely follow the format of a guided math plan. Each day, students will begin with a math warm-up question. While students complete this problem, the teacher will spend time conferring with students individually. Next, students have time to share strategies with one another and discuss their thoughts as a class.

Following the warm-up, which may take approximately 10-15 minutes, will be a whole group mini-lesson. Each time a new concept has been assigned for homework through a flipped learning video the night before, the next day's lesson will begin with a

whole group mini-lesson reviewing the concepts, strategies and vocabulary from the video. The videos will be 8-15 minutes in length and focus on one specific fraction concept, such as adding fractions with common denominators. Students will be expected to keep a math journal where they record the vocabulary, samples, and practice problems for each video. Additionally, students will write down questions they have about the strategy or concept. Other days, the whole group mini-lesson will be a mathematical read-aloud or challenge work. Mini-lessons should last approximately 15 minutes. Additionally, the whole group time will be used to introduce the independent and partner work that students will complete over the next few days during the math workshop.

The math workshop will follow the whole-group instruction. It will involve students completing various math practice and activities while the teacher meets with small groups for targeted instruction at each group's level. The workshop lasts between 30 and 45 minutes. The math period will end each day with an exit slip where students answer a math question on the current fraction concept students have been studying. The teacher will use this information as a formative assessment to target students for conferring or for flexibly adjusting the instructional groups.

## Summary of the Chapter

In this chapter, I have discussed the rationale, model, and format for the curriculum I will create to answer the research question, *How can I design a math curriculum that will increase fifth grade students' understanding of fraction concepts?* After analyzing literature on four types of instructional strategies, I have determined that this curriculum will become a hybrid of both guided math and flipped learning. This

curriculum will include five weeks of fractions lessons that are 60-75 minutes in length and focus on the eight Minnesota Academic standards that involve fractions in fifth grade. The curriculum will be created using the Understanding by Design model. The curriculum design will first consider the desired results, then what evidence will be needed to determine if those results were met, and finally what lessons and activities will be used each day to reach the desired results (Wiggins & McTighe, 2005).

In the next chapter, I will discuss the results of my research in the form of the curriculum I have designed for increasing fifth grade students' understanding of fraction concepts. I will address the intended participants and setting of the curriculum, curriculum design, and the daily lessons and structure created for the purpose of this project.

# CHAPTER FOUR

## Results

### Overview

In this chapter, I will outline the results of my project, which was the creation of a five-week fractions unit for fifth graders in the state of Minnesota. The basis for this curriculum is the Understanding by Design model (UbD) from Wiggins and McTighe (2005). The overall plan for the curriculum, following the UbD model, can be found in the appendix. As described more in-depth in Chapter Three, the UbD model outlines the standards, understandings, essential questions, knowledge, skills, performance tasks, assessment evidence, and learning activities for the curriculum.

In the following sections, I will describe the participants and setting for which the curriculum was created, the curriculum design, and the daily lessons. Many of the actual materials can be found in the appendix. This curriculum is the result of my project which investigated the question, *How can I design a math curriculum that will increase fifth grade students' understanding of fraction concepts?*

### Participants and Setting

As described in the previous chapter, this curriculum is intended for use in a fifth grade classroom in the state of Minnesota. In general, this curriculum was based on the expectations that the class would be of mixed abilities with all students having access to the internet at home. More specifically, as this curriculum was being created, three different types of participants emerged. The students participating in this curriculum will generally fall into one of three categories in terms of math achievement: below grade

level, at grade level, or above grade level. It was important to consider how to reach the neediest of students in each of these three groups.

Teachers are typically able to identify those students performing below grade level rather easily. In math, these students lack number sense and fluency with basic facts. In fifth grade, these students are often aware of their shortcomings and demonstrate this through lack of self-confidence or a negative attitude toward the subject as a whole. These students need a lot of time developing their number sense with a focus on the basic multiplication and division facts. Since math content continues to become more difficult as students move forward in school, these students must have the basic foundational skills in place in order to continue progressing successfully through the content.

High achieving math students, while able to complete grade level work with ease, sometimes lack the ability to explain their math thinking orally, in written work, or both. Their brains move so quickly that they often do not realize what it is that they are doing when solving math problems. Participation in group number talks, used as part of a math warm-up, for example, often involve problems that are called “low-floor high-ceiling.” This means that students of all abilities can access them, but the problems simultaneously offer advanced challenges. Working with such problems can bring high-achieving students more practice with noticing and naming their solving strategies. This translates to students gaining a deeper understanding of the content.

A group that often falls through the cracks are the students who perform right on grade level. Without careful instruction, the students in this group could fall into the below-grade level achievers. This group of students can often be “work completers.”

These students consistently complete work in class at what appears to be a sufficient level, but they often struggle to transfer their knowledge to other concepts or demonstrate proficiency away from a teacher's watchful eye. These students often appear to understand the content, but in reality do not retain the full knowledge. These students need work with understanding math processes and vocabulary at a deeper level to expand their foundational knowledge.

I considered these three groups of students the most throughout this project. When creating this curriculum, it is important for teachers to be aware of such students within each group in order to teach them effectively via both whole and small group instruction. With this in mind, I have made sure there are multiple times within the curriculum design that allow for teachers to spend time developing the skills needed in each group.

## Curriculum Design

Traditionally, mathematics curricula are created to meet the needs of an average student who can achieve proficiency with grade level standards. The content is typically delivered in a whole group lesson with little to no time for teachers to meet the needs of each learner. Homework is assigned as paper-and-pencil practice on the objective of the day, where, because of various home lives of students, parents may or may not intervene or assist. In this curriculum, the homework is a preview of the next day's lesson so that students have some background knowledge on the content that will be delivered by the teacher in small groups with other students at the same instructional level. The goal is to have students practicing the concepts with the teacher so that the teacher knows exactly what the students need to learn.

It is important to emphasize that this curriculum has not yet been implemented in a real fifth grade classroom. Therefore, it is impossible at this point to adequately evaluate its strengths or deficiencies. However, one aspect that comes to mind immediately is something that can be identified as both a potential benefit and potential drawback of trying this curriculum in an actual classroom. Access to technology is vital to implementing this curriculum with fidelity. While that can be an engaging aspect for students, with the individualization that can occur and the ability they have to review the content as much as they need, it can also provide a hurdle for schools or students who do not have that access. Without proper technology, this curriculum cannot be implemented as intended.

In a seventy-five-minute class period, the structure of each day is as follows: 10 minutes for math warm-up, 15 minutes for mini-lesson, 45 minutes for math workshop, and 5 minutes for assessment. Classes with a shorter time frame could restructure the times as needed, such as a 30-minute workshop with shorter small group intervals. This structure is based on the guided math frameworks from Sammons (2009). Because guided reading is an integral part of the intended district's literacy curriculum, the structure, flow, and independence will be familiar to students. Solid routines with a repetitive structure provide students with a consistency that allows them to know what to expect while also saving valuable instructional time for a larger focus on content, instead of class management.

During the math warm-up, students complete a short math activity, share with a partner, and then discuss with the whole group. While the students are completing the

activity, the teacher checks each student's math notebook to assess completion of the previous night's homework. Such homework asks students to watch a topical math video, take notes on vocabulary and examples, and try sample problems. The math warm-up is typically one of these four activities for this particular curriculum: *Problem of the Day, Number of the Day, What's Next? Pattern,* and *How Did My Family Use Math This Week?* This is the time for teachers to circle back to other concepts covered throughout the course of the year and prepare for the Minnesota Comprehensive Assessments (MCAs). Such topics for the math warm-up would usually not include fractions, as this is a separate entity within the curriculum, but the teacher could decide to focus on fraction concepts if that is what the students need. For the purposes of this unit, one example of each math warm-up will be given and repeated throughout the days, but teachers should change the problem to be a new one that fits what the teachers wish to review each time. Additionally, teachers may choose to substitute an entirely different activity for the math warm-up.

In the mini-lesson, teachers read aloud a math picture book, review the previous night's homework, focus on vocabulary use, and deliver instructions for the day's math workshop. Because of the independent nature of the workshop, which ensures that teachers can spend uninterrupted blocks of time instructing, activities for students to do on their own must be introduced and explained during the mini-lesson.

The math workshop is for small group instruction targeted to the needs of a particular group of students. Three groups are the minimum, but teachers can adapt to meet the needs of the class. The three groups must include students above grade level, on

grade level, and below grade level, as previously described. During the workshop, students meet with the teacher, and, while the teacher is meeting with the other groups, students complete other math activities. These activities include fact fluency, math games, and individual content practice. The number of activities depends upon how many groups meet with the teacher each day. For the purposes of this curriculum, two activities are described for each day. However, other activities can be substituted for the ones mentioned. While students meet with the teacher, small group objectives will depend upon the day's content (based on the previous night's homework). Such small group activities are not described in this curriculum because instruction should be targeted to the needs of the specific group of students for a particular day.

Finally, the lesson concludes with an assessment. The assessments in this curriculum include exit slips, quizzes, journal entries, and a final test. All assessments can be modified by the user of the curriculum to meet the needs of a particular class. Students have homework each night to follow the flipped learning ideal of pre-learning a concept the night before class via electronic media. As previously stated, the participants of this curriculum will have their own school-issued iPad mini, but other students with internet access could successfully complete the homework as well. The videos for this curriculum were taken from the websites www.iflip4math.org and www.brentcoley.com, and require students to take notes on the vocabulary, examples, and practice questions in their math notebooks.

The following pages describe an overview of each day's activities for the 25-day unit. All activities should be adapted to meet the needs of the class. The Understanding

by Design (UbD) framework, including a list of books and homework videos, can be found in the appendix.

Daily Lessons

Section 1. Each set of lessons below are organized by sequencing specific content and teaching points through the clustering of similar topics. Day 1 is a standalone teaching day to introduce the topic, gauge students' initial grasp of fractions as a whole, and assess students' knowledge of the specific fraction content that will be covered over the course of the unit. Because fractions have been taught in at least two grades prior to fifth, the unit begins with a focus on irregular fractions: mixed numbers and improper fractions. Students need to understand both in terms of value and the relationship between the two. Day 2, Day 3, and Day 4 focus on these two items in addition to learning how to convert one into the other and vice versa. Day 5 and Day 6 are spent understanding and calculating equivalent fractions. Building a base of knowledge with finding equivalent fractions will aid students in learning to reduce fractions to simplest form later in the unit.

**Day 1**

*Math Warm-up*: Locate 2/3 on a number line segment—between -1 and 0, 0 and 1, 1 and 2, or 2 and 3—to determine if students understand the value of a fraction as a real number. (Plan on warm-up taking longer than usual today to instill a strong introduction to fractions.)

*Mini-lesson*: Watch the "Fractions" video from the site https://www.brainpop.com/math/numbersandoperations/fractions/ (this is a subscription site, but anyone can sign up for a two-week free trial). This video is a general overview

of vocabulary and basic concepts to review what students already know from third and fourth grade, while also introducing students to new ideas that will be taught throughout the unit. Take the quiz that follows the video as a whole group to gauge for understanding of initial fraction concepts. BrainPop is an interactive website that works well with a SmartBoard for students to complete activities as a whole group.

*Workshop*: Complete the activity from the BrainPop video (printable from the above link) in pairs or individuals. The activity is a chance for students to record what they think key vocabulary terms mean, such as *denominator* and *numerator*. Informally assess to determine possible instructional groups for tomorrow's workshop.

*Assessment:* Use the final, end-of-unit test as a pre-test today to prepare instructional groups for tomorrow's workshop. Students should be grouped homogenously by the results. Groups could sorted by overall fraction ability or by specific concept, at the teacher's discretion. The goal is to give the students what they need, which can and will change, depending upon the entire class, both within a unit and year-to-year.

*Homework*: Watch the video "9-3 Part 1: Convert mixed numbers to improper fractions" from www.iflip4math.org and take notes on vocabulary, examples, and practice problems. Each video from both Rebecca Gooding at www.iflip4math.org and Brent Coley at www.brentcoley.com, who both have used flipped learning in their own mathematics classrooms, are titled by the concept that will be the focus of that particular video. When visiting the two websites, teachers can search by the title or number to find the video quickly. Each video is formulaic in terms of students knowing what to expect

from an introduction, to vocabulary, to structured examples, to practice problems with stopping points prompted by the teacher facilitator. Any practice problems are explained both visually and orally.

**Day 2**

*Math Warm-up*: Represent ¼ by drawing as many different ways as possible. For examples, students may draw 4 people and circle one, divide a square into 4 equal parts and shade one, cut a pie into four pieces and color one in, one quarter out of a dollar, etc. Generate a class list as they share. Teachers may choose to display this list of visuals for future reference throughout the unit.

*Mini-lesson*: Introduce the workshop and explain procedures. Students will be rotating through three stations: small group instruction with the teacher on the content from the previous night's homework video, independent practice on IXL.com with the same concept of the day, and fact fluency work with a game or computer program. Students need to understand how to utilize classmates when they have questions so that small group instruction time is not interrupted. All materials, manipulatives, and handouts must be easily accessible and students need to know how to use the work time successfully when they are not meeting with the teacher.

Introduce the website www.xtramath.org. This is a free, fact fluency website that can be tailored to the needs of students: addition, subtraction, multiplication, and division facts in three seconds or less is the default program. As students reach proficiency in one operation, they move to the next. Teachers are able to observe progress with a detailed report for each student.

Introduce the website www.IXL.com. IXL requires a school subscription, but allows guest usage for 10-15 minutes each day. With a subscription, teachers can monitor proficiency and time spent working. If students answer incorrectly, a detailed explanation of how and why they were incorrect appears on the screen. Each day in this curriculum, students will complete an IXL lesson based on the content objective of the day as one of the activities they do when not meeting with the teacher. On the IXL website, students need to click on the fifth grade tab, scroll down to the proper group of lessons (by letter as indicated each day) and pick the lesson they are to work on for the day (by number, as indicated each day).

*Workshop*: Today's stations include small group instruction, fact fluency work on www.xtramath.org, and individual practice with www.ixl.com on fifth grade concept K.1: Fractions review.

*Assessment*: Students make a journal entry in their math notebook to answer the essential question, "*How are fractions part of everyday life*?" At this point, the answers will be very simple, such as in cooking a recipe, measuring the floor for new carpet, etc. There are three essential questions in this unit plan, which are outlined in the Understanding by Design framework in the appendix. Each question will be asked early in the unit to gather initial insights and will be asked again at the end to assess knowledge gained for real world implications.

*Homework*: Watch the video "9-3 Part 2: Convert improper fractions to mixed numbers" from www.iflip4math.org and take notes on vocabulary, examples, and practice problems.

**Day 3**

*Math Warm-up:* Complete a number of the day form with a number chosen by the teacher. A blank number of the day form can be found in the appendix. A number of the day form can be filled with any number the teacher feels is a strong teaching point for the day. The worksheet asks students to then write that number in expanded form, word form, add or subtract various amounts from that number, and round to the nearest various place value, as well as other mathematical concepts. For example, if the number of the day is 653, expanded form will be *600 + 50 +3*, word form would be *six hundred fifty three*, etc.

*Mini-lesson:* Read aloud and discuss the first half of the book *Working with Fractions* by David Adler (2009). This book serves as a strong introduction to fractions with a focus on vocabulary. Introduce the game Multiplication Headbands for use during workshop. Multiplication Headbands is a game that requires three people per group and a deck of cards. The dealer gives the other two players a card for them to hold on their foreheads, facing the other player. The dealer multiplies the two cards and gives the players the product. Based on what the dealer says and on what card the other person is holding, each player must guess what their own card is worth. For example, if the dealer says “24” and the other player is holding an “8,” the third player would surmise that they must be holding a “3.” The player who guesses their card correctly the fastest gets to collect both cards for that round. Play continues through the entire deck, and then students can change roles. A full game would include three rounds so that each student gets an opportunity to be the dealer, but teachers can modify the game as needed.

*Workshop:* Today's stations include small group instruction, fact fluency work in the game Multiplication Headbands, and individual practice with www.ixl.com on fifth grade concept K.2: Understanding fractions with word problems.

*Assessment:* Students make a journal entry in their math notebook to answer the essential question, "*How would the world be different without fractions?"* Answers from the students at this point in the unit will not be very complex. Expect such answers as "*It will be difficult to divide things evenly,"* or "*We couldn't make recipes."* This is the second of three essential questions for this unit. As with the first one, students will answer this now, near the beginning of the unit, and later, toward the end of the unit, to demonstrate growth and understanding with extending fraction concepts outside of the mathematics classroom.

*Homework*: Watch the video "Converting Improper Fractions to Mixed Numbers, & Converting Mixed Numbers to Improper Fractions" from www.brentcoley.com and take notes on vocabulary, examples, and practice problems.

**Day 4**

*Math Warm-up:* Identify the next numbers in a pattern. Students should try to find the next three numbers in the pattern, the tenth number, the fiftieth number, and the one-hundredth number. Students should also write down the rule for how to make the pattern. This can all be done in their math notebooks and adjusted as the teacher sees fit. For example, if the pattern given was 1, 2, 4, 8, students would write 16, 32, 64 for the next three numbers, 512 for the tenth number, 562,949,953,421,312 for the fiftieth number, and so on. The pattern is n x 2, or, the previous number doubled.

*Mini-lesson:* Review and discuss the following vocabulary words: *numerator*, *denominator*, *mixed number*, *improper fraction*, and *convert*. Students will have written these in the notebooks from the previous day's homework. Be sure students understand why an improper fraction is considered improper (because the numerator is larger than the denominator) and the relationship between improper fractions and mixed numbers (mixed numbers show how improper fractions are actually more than one whole).

*Workshop*: Today's stations include small group instruction, fact fluency work on www.xtramath.org, and individual practice with www.ixl.com on fifth grade concept K.5: Convert between improper fractions and mixed numbers.

*Assessment:* Students complete quiz #1, found in the appendix, on converting improper fractions to mixed numbers and vice versa. The teacher may choose to re-group the students after correcting these quizzes, as can happen at any time throughout the unit, to better meet the needs of the learners.

*Homework*: Watch the video "9-4: Equivalent fractions" from www.iflip4math.org and take notes on vocabulary, examples, and practice problems.

**Day 5**

*Math Warm-up:* In math notebooks, students answer the question, "*How did my family use math this week?*" Students make a list of ways and attempt to find unique examples of math being used at home, then share with the class. For example, a student might discuss how his mother doubled a recipe for a bake sale, and the adjustments she had to make when measuring ingredients.

*Mini-lesson:* Finish reading *Working with Fractions* by David Adler (2009). Discuss the story problems listed in the book to begin thinking about ways fractions are used in the real world, specifically focusing on equivalent fractions. Introduce the game Multiplication Roll 'em for workshop today. In this game, students roll two dice to get two factors. They multiply the numbers together to get a product and record their turn on a piece of paper or in their math notebooks. Each person takes turns rolling the dice and recording their factors and products. For each round (one turn each) the person who has the highest product earns a point. The person with the most points at the end of the game wins (certain time limit or number of turns, as decided by the teacher). A way to make it more challenging is to roll the two dice and add them together for each factor, in order to produce factors up to 12, instead of just 1-6. Additionally, students could add up all of their products at the end to determine a winner, instead of round by round.

*Workshop*: Today's stations include small group instruction, fact fluency work in the game Multiplication Roll 'em, and individual practice with www.ixl.com on fifth grade concept K.3: Equivalent fractions.

*Assessment*: Students answer an equivalent fraction sample problem on a Daily Math exit slip. Daily Math exit slips can be on post-it notes or on blank paper divided into fourths. The exit slips are a way to gather teaching points for students who may need remediation the following day. An adequate problem may be one of the following: *Is 7/12 equivalent to 13/18?* (No.) *How many 12ths are equivalent to 2/3?* (8/12). *List three different fractions that are equivalent to 4/16.* (Answers will vary, but may include ¼, 2/8, 3/12.)

*Homework*: Watch the video "9-5: Compare and order fractions and mixed numbers" from www.iflip4math.org and take notes on vocabulary, examples, and practice problems.

**Day 6**

*Math Warm-up:* Complete a Problem of the Day in math notebooks with a problem of the teacher's choosing. Typically, Problems of the Day are a time for skills practice for the Minnesota Comprehensive Assessments (MCAs) and are preferably word problems. Many schools have various test preparation practice problems they prefer to use. When discussing the problem of the day, focus on the language used in the problem to emphasize the correct operations students should use to solve them. For example, "in all" should signal to the students that they should be using addition to solve this problem, whereas "how many more than" would signal subtraction.

*Mini-lesson:* Spend time reviewing how number lines are constructed, how they work, and how to use benchmarks within a number line to prepare for upcoming content. It is vital for students to realize that hash marks on a number line between consecutive numbers represent part of the whole. Hash marks are always equidistant and can be named with a fraction. Consider bringing in a ruler or a measuring tape to demonstrate this. Draw examples on the easel and have students copy down the number lines in their notebooks for reference. The denominator depends on how many hash marks are between each whole number.

*Workshop*: Today's stations include small group instruction, fact fluency work on www.xtramath.org, and individual practice with www.ixl.com on fifth grade concept K.8: Compare fractions using benchmarks.

*Assessment*: Students answer a fraction comparison sample problem on a Daily Math exit slip. Daily Math exit slips can be on post-it notes or on blank paper divided into fourths. For example, ask students which fraction is larger: *7/16 or 5/8*? Students should be able to realize that 7/16 is less than half (a benchmark fraction) and 5/8 is greater than half.

*Homework*: Watch the video "Least Common Multiples & Comparing Fractions" from www.brentcoley.com and take notes on vocabulary, examples, and practice problems.

Section 2. The next set of lessons moves on to learning about how to compare and order sets of fractions and mixed numbers. Students need to understand how finding greatest common factors and least common multiples helps them identify whether one fraction is greater than, less than, or equal to another. When changing denominators, students need to also understand how to change the numerator with a proper ratio. Using benchmark numbers, such as 0, ½, and 1, is another important tool for students to use when comparing and ordering fractions. Days 10 and 11 focus on reducing fractions to simplest form. Familiarity with factors and multiples is key for students to be able to quickly see that a fraction can be simplified. Beginning with noticing if both the numerator and denominator are divisible by two is a common place to start.

**Day 7**

*Math Warm-up:* Complete a number of the day form with a number chosen by the teacher. A blank number of the day form can be found in the appendix. A number of the day form can be filled with any number the teacher feels is a strong teaching point for the day. The worksheet asks students to then write that number in expanded form, word form, add or subtract various amounts from that number, and round to the nearest various place value, as well as other mathematical concepts. For example, if the number of the day is 653, expanded form will be *600 + 50 +3*, word form would be *six hundred fifty three*, etc.

*Mini-lesson:* Read aloud and discuss the book *Fractions = Trouble* by Claudia Mills (2012). This book begins to open up discussion about why fractions are difficult for students, which is important as students often arrive in fifth grade with negative feelings about fractions.

*Workshop*: Today's stations include small group instruction, fact fluency work in the game Multiplication Headbands, and individual practice with www.ixl.com on fifth grade concept K.9: Compare fractions and mixed numbers.

*Assessment*: Students complete quiz #2, found in the appendix, on comparing and ordering fractions and mixed numbers. The teacher may choose to re-group the students after correcting these quizzes, as can happen at any time throughout the unit, to better meet the needs of the learners.

*Homework*: Watch the video "9-6: Common factors and greatest common factors" from www.iflip4math.org and take notes on vocabulary, examples, and practice problems.

**Day 8**

*Math Warm-up:* Identify the next numbers in a pattern. Students should try to find the next three numbers in the pattern, the tenth number, the fiftieth number, and the one-hundredth number. Students should also write down the rule for how to make the pattern. This can all be done in their math notebooks and adjusted as the teacher sees fit. For example, if the pattern given was 1, 2, 4, 8, students would write 16, 32, 64 for the next three numbers, 512 for the tenth number, 562,949,953,421,312 for the fiftieth number, and so on. The pattern is n x 2, or, the previous number doubled.

*Mini-lesson:* Review and discuss the definitions of factors and inequalities. Factors are the two numbers that are multiplied together to calculate a product. Inequalities are number sentences such as ½ < ¾ that show a certain amount is greater than or less than another amount. Review procedures for creating factor trees and finding greatest common factors and least common multiples. A factor tree starts with a product and then lists the factors until all prime numbers are reached. For example, if the product is 48, a student would write *6x8=(2x3)x(2x4)=(2x3)x2x(2x2).*

*Workshop*: Today's stations include small group instruction, fact fluency work on www.xtramath.org, and individual practice with www.ixl.com on fifth grade concept F.6: Greatest common factor.

*Assessment*: Students answer a factor tree sample problem on a Daily Math exit slip. Daily Math exit slips can be on post-it notes or on blank paper divided into fourths. As stated above, students need to be able to break down a product into its prime number factorization string. For example, *24=4x6=(2x2)x(2x3).*

*Homework*: Watch the video "Factors & Greatest Common Factors" from www.brentcoley.com and take notes on vocabulary, examples, and practice problems.

**Day 9**

*Math Warm-up* Complete a Problem of the Day in math notebooks with a problem of the teacher's choosing. Typically, Problems of the Day are a time for skills practice for the Minnesota Comprehensive Assessments (MCAs) and are preferably word problems. Many schools have various test preparation practice problems they prefer to use. When discussing the problem of the day, focus on the language used in the problem to emphasize the correct operations students should use to solve them. For example, "in all" should signal to the students that they should be using addition to solve this problem, whereas "how many more than" would signal subtraction.

*Mini-lesson:* Read aloud and discuss the book *The Lion's Share* by Matthew McElligott (2012). This book serves as a strong reminder of how fractions are important in the real world and that what the students are learning and will learn in this unit will be applied in their lives.

*Workshop:* Today's stations include small group instruction, fact fluency work in the game Multiplication Roll 'em, and individual practice with www.ixl.com on fifth grade concept F.7: Least common multiple.

*Assessment*: Students make a journal entry in their math notebook to answer the essential question, "*How are fractions, decimals, and division related?"* This is the third and final essential question in the Understanding by Design framework that can be found in the appendix. Students will revisit this question toward the end of the unit to demonstrate growth in understanding fractions. Such answers students may give at this time may include, "*All deal with parts of whole numbers*," or "*In division, a remainder can be given as a fraction or a decimal amount*."

*Homework*: Watch the video "9-7: Fractions in simplest form" from www.iflip4math.org and take notes on vocabulary, examples, and practice problems.

**Day 10**

*Math Warm-up:* In math notebooks, students answer the question, "*How did my family use math this week?*" Students make a list of ways and attempt to find unique examples of math being used at home, then share with the class. For example, a student might discuss how his mother doubled a recipe for a bake sale, and the adjustments she had to make when measuring ingredients.

*Mini-lesson:* Introduce the performance task project choices for this unit: Fractions in Baking, Fractions in Measurement, and Fractions at Home. Students will research, using the internet and at home, fractions in the real world. They will choose one of the three topics above and create a poster displaying all the information they collect. Students will share this research with the class near the end of the unit. Students who choose baking need to consider how fractions are used when measuring ingredients with

measuring cups and spoons, as well as how to adjust recipes to serve more or fewer people than the recipe originally can serve.

Students who choose measurement need to consider how rulers and tape measures work, as well as other linear measurement tools, and the conversions between units of measure. These students need to select the customary or metric system to focus their writing. The final option is more open-ended and is one to consider for the gifted and talented students. Students need to think how else fractions might be used at home, trying to avoid baking or measurement systems. These students might consider investigating the relationship between fractions and money, fractions and age, or fractions and time as possible project ideas. Teachers should make requirements fit the needs of their class.

*Workshop*: Today's stations include small group instruction, individual work time on the performance task project, and individual practice with www.ixl.com on fifth grade concept K.4: Reduce fractions to lowest terms

*Assessment*: Students answer a simplest form sample problem on a Daily Math exit slip. Daily Math exit slips can be on post-it notes or on blank paper divided into fourths. The exit slips are a way to gather teaching points for students who may need remediation the following day. An adequate problem may be one of the following: *Reduce 12/48 to simplest form.* (1/4). *What is one way to tell that you need to simplify 4/16 further?* (Both the numerator and denominator are even numbers.) *Is 2/5 in simplest form?* (Yes.)

*Homework*: Watch the video "Reducing Fractions" from www.brentcoley.com and take notes on vocabulary, examples, and practice problems.

**Day 11**

*Math Warm-up:* Complete a number of the day form with a number chosen by the teacher. A blank number of the day form can be found in the appendix. A number of the day form can be filled with any number the teacher feels is a strong teaching point for the day. The worksheet asks students to then write that number in expanded form, word form, add or subtract various amounts from that number, and round to the nearest various place value, as well as other mathematical concepts. For example, if the number of the day is 653, expanded form will be *600 + 50 +3*, word form would be *six hundred fifty three*, etc.

*Mini-lesson:* Read aloud and discuss the book *Piece = Part = Portion* by Scott Gifford (2008). This book outlines how fractions can have different names for the same amount, including as a decimal. The connection between fractions and decimals is clearly described with the use of illustrations.

*Workshop*: Today's stations include small group instruction, fact fluency work on www.xtramath.org, and individual practice with www.ixl.com on fifth grade concept K.7: Graph and compare fractions on number lines.

*Assessment*: Students complete quiz #3, found in the appendix, on reducing fractions to simplest form. The teacher may choose to re-group the students after correcting these quizzes, as can happen at any time throughout the unit, to better meet the needs of the learners.

*Homework*: Watch the video "9-8: Convert between fractions and decimals" from www.iflip4math.org and take notes on vocabulary, examples, and practice problems.

Section 3. The next group of lessons have two main purposes. First, students need to understand how to convert fractions to decimals and vice versa. It is important to note that is no further work with decimals is included in this unit, outside of mentions in some of the picture book read alouds. In fifth grade, decimals often comprise their own unit, usually immediately prior to or immediately following the fractions unit. Depending upon the experience of the students in the class with decimals, some additional time may need to be spent reviewing decimal place value.

We will also spend time reviewing adding and subtracting fractions with common denominators. This concept is covered in depth in fourth grade, so be sure that the class retained the information it learned that year, before moving on to the fourth section of lessons. Additionally, time in this section is also spent reviewing least common multiples from earlier in this unit to prepare for adding and subtracting fractions with unlike denominators in section four.

**Day 12**

*Math Warm-up*: Identify the next numbers in a pattern. Students should try to find the next three numbers in the pattern, the tenth number, the fiftieth number, and the one-hundredth number. Students should also write down the rule for how to make the pattern. This can all be done in their math notebooks and adjusted as the teacher sees fit. For example, if the pattern given was 1, 2, 4, 8, students would write 16, 32, 64 for the next three numbers, 512 for the tenth number, 562,949,953,421,312 for the fiftieth number, and so on. The pattern is n x 2, or, the previous number doubled.

*Mini-lesson:* Review and discuss place value of decimal numbers. Remind students that the place value of decimal places is as follows (from closest to the decimal point to furthest away): tenths, hundredths, thousandths, ten thousandths, hundred thousandths, millionths. Fifth grade students must be able to identify place value from millions down to millionths.

*Workshop*: Today's stations include small group instruction, fact fluency work in the game Multiplication Headbands, and individual practice with www.ixl.com on fifth grade concept G.12: Convert fractions to decimals.

*Assessment*: Students answer a sample problem for converting a fraction to a decimal on a Daily Math exit slip. Daily Math exit slips can be on post-it notes or on blank paper divided into fourths. The exit slips are a way to gather teaching points for students who may need remediation the following day. An adequate problem may be one of the following: *Convert 1/25 to a decimal*. (0.04) *Convert 37/100 to a decimal*. (0.37) *Convert 4/5 to a decimal*. (0.2)

*Homework*: Watch the video "9-9: Convert between fractions and decimals" from www.iflip4math.org and take notes on vocabulary, examples, and practice problems.

**Day 13**

*Math Warm-up:* Complete a Problem of the Day in math notebooks with a problem of the teacher's choosing. Typically, Problems of the Day are a time for skills practice for the Minnesota Comprehensive Assessments (MCAs) and are preferably word problems. Many schools have various test preparation practice problems they prefer to use. When discussing the problem of the day, focus on the language used in the problem

to emphasize the correct operations students should use to solve them. For example, “in all” should signal to the students that they should be using addition to solve this problem, whereas “how many more than” would signal subtraction.

*Mini-lesson:* Read aloud and discuss the book *Fractions, Decimals, and Percents* by David Adler (2010). This book provides a great introduction to converting between fractions and decimals and lays out the process clearly, with illustrations.

*Workshop*: Today’s stations include small group instruction, individual time to work on the performance task project, and individual practice with www.ixl.com on fifth grade concept G.13: Convert decimals to fractions.

*Assessment*: Students answer a sample problem for converting a decimal to a fraction on a Daily Math exit slip. Daily Math exit slips can be on post-it notes or on blank paper divided into fourths. The exit slips are a way to gather teaching points for students who may need remediation the following day. An adequate problem may be one of the following: *Convert 0.25 to a fraction in simplest form*. (1/4) *Convert 0.5 to a fraction in simplest form*. (1/2) *Convert 0.125 to a fraction in simplest form*. (1/8)

*Homework*: Watch the video “Converting Fractions to Decimals & Decimals to Fractions” from www.brentcoley.com and take notes on vocabulary, examples, and practice problems.

**Day 14**

*Math Warm-up:* Identify the next numbers in a pattern. Students should try to find the next three numbers in the pattern, the tenth number, the fiftieth number, and the one-hundredth number. Students should also write down the rule for how to make the pattern.

This can all be done in their math notebooks and adjusted as the teacher sees fit. For example, if the pattern given was 1, 2, 4, 8, students would write 16, 32, 64 for the next three numbers, 512 for the tenth number, 562,949,953,421,312 for the fiftieth number, and so on. The pattern is n x 2, or, the previous number doubled.

*Mini-lesson:* Spend today checking in with students as a whole group regarding their progress on the performance task project. Allow students to share and discuss with other students who are completing the same project. The purpose for this check-in is to remind students of their work and give them an opportunity to bounce research ideas or tips off of each other. The conversations may spark additional ideas for research or additions to their own projects.

*Workshop*: Today's stations include small group instruction, fact fluency work on www.xtramath.org, and individual practice with www.ixl.com on fifth grade concept G.16: Compare decimals and fractions.

*Assessment*: Students complete quiz #4, found in the appendix, on comparing and converting between fractions and decimals. The teacher may choose to re-group the students after correcting these quizzes, as can happen at any time throughout the unit, to better meet the needs of the learners.

*Homework*: Watch the video "10-1: Add and subtract fractions with like denominators" from www.iflip4math.org and take notes on vocabulary, examples, and practice problems.

**Day 15**

*Math Warm-up:* In math notebooks, students answer the question, "*How did my family use math this week*?" Students make a list of ways and attempt to find unique examples of math being used at home, then share with the class. For example, a student might discuss how his mother doubled a recipe for a bake sale, and the adjustments she had to make when measuring ingredients.

*Mini-lesson:* Read aloud and discuss the book *Funny and Fabulous Fraction Stories* by Dan Greenberg (1999). This book is filled with short stories on various fraction concepts. Specifically for this mini-lesson, choose the ones related to adding and subtracting fractions.

*Workshop*: Today's stations include small group instruction, fact fluency work in the game Multiplication Roll 'em, and individual practice with www.ixl.com on fifth grade concept L.4: Add and subtract fractions with like denominators (word problems).

*Assessment*: Students answer a like denominator addition sample problem and a like denominator subtraction sample problem on a Daily Math exit slip. Daily Math exit slips can be on post-it notes or on blank paper divided into fourths. The exit slips are a way to gather teaching points for students who may need remediation the following day. An adequate problem may be one of the following: *Add 3/8 and 4/8*. (7/8) *Subtract 3/10 from 8/10*. (5/10) *Give answers in simplest form*. (7/8 is already in simplest form. 5/10 becomes ½.)

*Homework*: Watch the video 10-2: Least common multiples" from www.iflip4math.org and take notes on vocabulary, examples, and practice problems.

**Day 16**

*Math Warm-up:* Complete a number of the day form with a number chosen by the teacher. A blank number of the day form can be found in the appendix. A number of the day form can be filled with any number the teacher feels is a strong teaching point for the day. The worksheet asks students to then write that number in expanded form, word form, add or subtract various amounts from that number, and round to the nearest various place value, as well as other mathematical concepts. For example, if the number of the day is 653, expanded form will be *600 + 50 +3*, word form would be *six hundred fifty three*, etc.

*Mini-lesson:* Review the procedure for how to find common denominators. Remind students that one way to find common denominators is to multiply the two uncommon denominators together and then do the same multiplication to the corresponding numerator. For example, 3/8 + 2/5. To find a common denominator, multiply 8 and 5 to get 40. The new denominator for both fractions is now 40. Because you multiplied 8 by 5, the numerator in 3/8 also gets multiplied by 5. Because you multiplied 5 by 8, the numerator in 2/5 also gets multiplied by 8. Therefore, the new addition problem becomes 15/40 + 16/40.

*Workshop*: Today's stations include small group instruction, individual time to work on the performance task project, and individual practice with www.ixl.com on fifth grade concept K.6: Least common denominator.

*Assessment*: Students make a journal entry in their math notebook to answer the essential question, "*How are fractions part of everyday life*?" After writing, students

should compare and contrast with the journal entry they made on Day 2 to the same question. Teachers should check for growth and any misconceptions to address prior to the unit ending. Students should be able to generate a much longer list of examples than they were able to at the beginning of the unit. Students may now recognize how they utilize fractions for dividing up their time, how fractions appear in nature, or how fractional patterns are found in architecture.

*Homework*: Watch "10-3: Add fractions with unlike denominators" from www.iflip4math.org and take notes on vocabulary, examples, and practice problems.

Section 4. The final group of content-driven lessons in this unit involves concepts that traditionally are the most difficult for fifth graders. A strong foundational base of understanding factors, multiples, and converting between improper fractions and mixed numbers will help students greatly in successfully achieving proficiency in these standards: adding and subtracting fractions and mixed numbers with unlike denominators. The entire unit has been leading students to this point, and the goal is for them to leave fifth grade with clear understanding of how to change denominators when adding and subtracting fractions or mixed numbers.

**Day 17**

*Math Warm-up:* Identify the next numbers in a pattern. Students should try to find the next three numbers in the pattern, the tenth number, the fiftieth number, and the one-hundredth number. Students should also write down the rule for how to make the pattern. This can all be done in their math notebooks and adjusted as the teacher sees fit. For example, if the pattern given was 1, 2, 4, 8, students would write 16, 32, 64 for the next

three numbers, 512 for the tenth number, 562,949,953,421,312 for the fiftieth number, and so on. The pattern is n x 2, or, the previous number doubled.

*Mini-lesson:* Read aloud and discuss the book *The Wishing Club* by Donna Jo Napoli (2007). This book infuses fractions into real life and is more of a story than a fraction-focused book. However, there are also word problems at the end to help students make connections between fractions and the real life examples in the story.

*Workshop*: Today's stations include small group instruction, fact fluency work on www.xtramath.org, and individual practice with www.ixl.com on fifth grade concept L.8: Add fractions with unlike denominators.

*Assessment*: Students make a journal entry in their math notebook to answer the essential question, "*How would the world be different without fractions*?" After writing, students should compare and contrast with the journal entry they made on Day 3 to the same question. Teachers should check for growth and any misconceptions to address prior to the unit ending. Students should be able to generate a longer list of examples than they were able to at the start of the unit. Students may now discuss such items as not being able to receive change at the store because parts of a dollar would not exist or how carpet may not fit certain rooms since it could not be cut to anything other than whole measurements.

*Homework*: Watch "10-4: Subtract fractions with unlike denominators" from www.iflip4math.org and take notes on vocabulary, examples, and practice problems.

**Day 18**

*Math Warm-up:* Complete a Problem of the Day in math notebooks with a problem of the teacher's choosing. Typically, Problems of the Day are a time for skills practice for the Minnesota Comprehensive Assessments (MCAs) and are preferably word problems. Many schools have various test preparation practice problems they prefer to use. When discussing the problem of the day, focus on the language used in the problem to emphasize the correct operations students should use to solve them. For example, "in all" should signal to the students that they should be using addition to solve this problem, whereas "how many more than" would signal subtraction.

*Mini-lesson:* Review the procedures for subtracting fractions with unlike denominators. Students need to first find a common denominator either by multiplying the denominators together or finding the least common multiple. Then, subtract using the new fractions. Finally, reduce the fractions to simplest form.

*Workshop*: Today's stations include small group instruction, fact fluency work in the game Multiplication Headbands, and individual practice with www.ixl.com on fifth grade concept L.10: Subtract fractions with unlike denominators.

*Assessment*: Students make a journal entry in their math notebook to answer the essential question, "*How are fractions, decimals, and division related*?" After writing, students should compare and contrast with the journal entry they made on Day 9 to the same question. Teachers should check for growth and any misconceptions to address prior to the unit ending. Students should be able to generate a longer list of examples than they were able to at the beginning of the unit. Students should be able to realize that

fractions and decimals are partners in mathematics and are simply two different ways to name the same amount. They should also discuss how division is used to create and identify fractions and decimals.

*Homework*: Watch the video "Adding and Subtracting Fractions" from www.brentcoley.com and take notes on vocabulary, examples, and practice problems.

**Day 19**

*Math Warm-up:* Complete a number of the day form with a number chosen by the teacher. A blank number of the day form can be found in the appendix. A number of the day form can be filled with any number the teacher feels is a strong teaching point for the day. The worksheet asks students to then write that number in expanded form, word form, add or subtract various amounts from that number, and round to the nearest various place value, as well as other mathematical concepts. For example, if the number of the day is 653, expanded form will be *600 + 50 +3*, word form would be *six hundred fifty three*, etc.

*Mini-lesson:* Spend today checking in with students as a whole group regarding their progress on the performance task project. Allow students to share and discuss with other students who are completing the same project. The purpose for this check-in is to remind students of their work and give them an opportunity to bounce research ideas or tips off of each other. The conversations may spark additional ideas for research or additions to their own projects. Remind students of the due date.

*Workshop*: Today's stations include small group instruction, individual time to work on the performance task project, and individual practice with www.ixl.com on fifth

grade concept L.11: Add and subtract fractions with unlike denominators (word problems).

*Assessment*: Students complete quiz #5, found in the appendix, on adding and subtracting fractions with unlike denominators. The teacher may choose to re-group the students after correcting these quizzes, as they can at any time throughout the unit, to better meet the needs of their learners.

*Homework*: Watch the video "10-5: Add mixed numbers" from www.iflip4math.org and take notes on vocabulary, examples, and practice problems.

**Day 20**

*Math Warm-up:* In math notebooks, students answer the question, "*How did my family use math this week*?" Students make a list of ways and attempt to find unique examples of math being used at home, then share with the class. For example, a student might discuss how his mother doubled a recipe for a bake sale, and the adjustments she had to make when measuring ingredients.

*Mini-lesson:* Read aloud and discuss the book *Polar Bear Math* by Ann Whitehead Nagda (2007). Real world connections between life at a zoo the importance of fractions to keeping the animals safe and healthy allow students to see yet another way fractions are important outside of math class.

*Workshop*: Today's stations include small group instruction, fact fluency work in the game Multiplication Roll 'em, and individual practice with www.ixl.com on fifth grade concept L.18: Add mixed numbers with unlike denominators.

*Assessment*: Students answer an adding mixed numbers with unlike denominators sample problem on a Daily Math exit slip. Daily Math exit slips can be on post-it notes or on blank paper divided into fourths. The exit slips are a way to gather teaching points for students who may need remediation the following day. An adequate problem may be something like: *3 ½ + 2 ¼.* (5 ¾)

*Homework*: Watch the video "10-6: Subtract mixed numbers" from www.iflip4math.org and take notes on vocabulary, examples, and practice problems.

**Day 21**

*Math Warm-up:* Complete a number of the day form with a number chosen by the teacher. A blank number of the day form can be found in the appendix. A number of the day form can be filled with any number the teacher feels is a strong teaching point for the day. The worksheet asks students to then write that number in expanded form, word form, add or subtract various amounts from that number, and round to the nearest various place value, as well as other mathematical concepts. For example, if the number of the day is 653, expanded form will be *600 + 50 +3*, word form would be *six hundred fifty three*, etc.

*Mini-lesson:* Review procedure for ungrouping mixed numbers with unlike denominators when subtracting. First, students must find common denominators using one of the procedures taught earlier in the unit. Then, students ungroup by converting the mixed number to an improper fraction. For example, 6 ¼ would become 25/4. Once the subtraction is complete, students need to reduce the fraction to simplest form. (6 ¼ - 3 ½ becomes 25/4 – 14/4 and equals 11/4. Simplest form = 2 ¾)

*Workshop*: Today's stations include small group instruction, fact fluency work on www.xtramath.org, and individual practice with www.ixl.com on fifth grade concept L.19: Subtract mixed numbers with unlike denominators.

*Assessment*: Students complete quiz #6, found in the appendix, on adding and subtracting mixed numbers with like and unlike denominators. The teacher may choose to re-group the students after correcting these quizzes, as can happen at any time throughout the unit, to better meet the needs of the learners.

*Homework*: Assigned as needed by the teacher.

Section 5. The final group of lessons are for review and assessment. As described below, teachers may choose to lengthen the unit due to the need for the class to be enriched or remediated. A day for whole unit review and a day for final assessment are included at the end. Teachers may use this section of four days at their discretion to be sure that all standards have been covered adequately.

**Day 22 and Day 23**

These can be used as catch-up days so that throughout the unit, if a class has difficulties with certain concepts, the teacher can choose to slow down and expand instruction. The teacher may choose to have students review IXL activities where they did not reach proficiency standards, or provide opportunities for enrichment with IXL by having them complete activities such as L.20: Add and subtract mixed numbers (word problems) or L. 21: Add and subtract fractions in recipes. IXL offers many different activities that can also be brought down to a fourth grade level or up to a sixth grade level

(or higher) on the same concepts covered in the fifth grade class. Additionally, spend part of one or both days sharing the performance task projects.

**Day 24**

*Math Warm-up:* There is not a warm-up today.

*Mini-lesson:* There is not a mini-lesson today.

*Workshop*: Complete a review of the unit. See the post-test in the appendix to assist in creating review problems that address the key concepts of the unit.

*Assessment*: There is not an assessment today.

*Homework*: Review math notebook at home to prepare for final unit assessment tomorrow.

**Day 25**

*Math Warm-up:* There is not a warm-up today.

*Mini-lesson:* There is not a mini-lesson today.

*Workshop:* There is not a workshop today.

*Assessment:* Complete the final summative fraction assessment found in the appendix.

Summary of the Chapter

This curriculum, intended for use in a fifth grade classroom in the state of Minnesota, details 25 days of lessons for a fractions unit. Each lesson includes a math warm-up, mini-lesson, workshop (where students take part in a rotation of three different activities), assessment, and homework. It is important to note that the intended

participants of this curriculum would have access to a school-issued iPad mini for use at home and school.

In the next chapter, I will review my capstone project. I will reflect upon my capstone journey, revisit the literature review from Chapter Two, draw conclusions regarding the implications and limitations of my findings, and consider my future research plans.

# CHAPTER FIVE

# Conclusion

## Overview

The previous chapter outlined the results of my curriculum project that answered my research question, *How can I design a math curriculum that will increase fifth grade students' understanding of fraction concepts?* I carefully considered the possible participants of this curriculum, the professional research on various instructional practices for mathematics, and my personal history with the subject. As a result, I created a five-week unit on fractions that utilized flipped learning and guided math.

In this chapter, I will reflect upon the capstone process as a whole and I will revisit the literature review from Chapter Two that grounded my work in this project. Additionally, I will discuss the possible implications and limitations of someone implementing this curriculum. Finally, I will address my future research plans.

## Reflections on the Capstone Process

During the fall semester in 2014, I began considering what I might pursue for my capstone project. I was initially planning to investigate a possible action research project regarding standards-based grading and its effect on fifth grade students' literacy achievement. As is so often the case in education, however, declining enrollment at my school resulted in me being displaced to another building for the upcoming school year. During the spring semester in 2015, I began the drafting process in the capstone practicum course with a very uncertain teaching future. Because of not knowing exactly what school I would be teaching at or what grade I would be teaching, I had to

completely switch gears and choose a new topic—one that did not require me to complete action research in a classroom.

My new project is the one which I completed for this capstone. I reflected on what I thought was most lacking for teachers in my district and realized that my teammates and I spent the majority of our time attempting to find the best resources and materials to teach math. Having most recently been teaching in a fifth grade classroom, those standards were most familiar to me, as was the way fifth graders behave and learn. This combination of factors resulted in me finally deciding to create a math curriculum on fraction concepts for fifth grade students—an area where our students historically had underperformed on standardized tests.

The capstone process was a seemingly daunting task. The thought of completing this project was at times overwhelming. During the capstone practicum, though, I had every resource I needed: examples, supportive peers, clear outlines and expectations, and an extremely helpful professor. All of these things made the writing of the first three chapters much more manageable than I had expected. I was engrossed in reading the literature I found regarding best practice in mathematics instruction and was able to set my course for finishing my capstone in the fall.

Throughout the drafting of chapter four, I discovered just how difficult it is to create a curriculum. There is so much to consider: standards, sequence of content, instructional methods, technology access, students, assessments, and more. However, I feel that I created something that could benefit the students of the district in which I teach, and that was my original goal. I also feel that spending the time creating this single

unit has afforded me knowledge going forward that will help me adjust lessons and manage content to better instruct my students no matter the grade level or subject area.

As I consider how far I have come from the start of this project to now, I need to reflect upon whether the results of the capstone match the curriculum I intended to write. Back in Chapter Three, I discussed what kind of curriculum I hoped to create. I wanted to design a fractions curriculum for future implementation in a fifth grade classroom in the district in which I currently teach. It was important to me, after researching various instructional strategies and taking into account what is already in place in my district, to utilize both guided math and flipped learning as the basic structure for my curriculum. Also, it needed to address all of the state standards that are assessed on the Minnesota Comprehensive Assessments (MCAs).

I feel that I was successful in matching my intentions to the actual results. When writing a curriculum, in comparison to conducting an action research project, the writer is able to have complete control over the results. There are no variables or research results to consider; I was able to ensure that the curriculum I created was exactly what I wanted to achieve.

Revisiting the Literature Review

The four instructional strategies I chose to research for this project were ability grouping, flipped learning, guided math, and differentiation. Throughout the research process, I discovered many positive attributes for each strategy, as well as some similarities across each. However, as with any instructional practice, there were also drawbacks to all of them. Viewing each through an evaluative lens resulted in a relatively

even playing field. My ultimate decision to choose a combination of flipped learning and guided math was as much a choice based on the research as it was based on my teaching situation.

As I began this journey, flipped learning was the instructional strategy with which I had the least experience. The research from Herreid and Schiller (2013) was what convinced me to consider incorporating flipped learning into my curriculum. Herreid and Schiller (2013) said that "flipped learning, with its use of videos that engage and focus student learning, offers us a new model for case study teaching, combining active, student-centered learning with content master that can be applied to real-world problems" (p. 65). A large focus of the mathematics standards for fifth graders in Minnesota revolves around real-world problem solving, and I have continually seen the need for development in this area with the fifth graders in my classroom.

Another aspect of my research that was critical in determining my instructional strategies was a quote from Tucker (2012), who cited a teacher who found the biggest benefit of flipped learning to be the ability to "more easily query individual students, probe for misconceptions around [mathematical] concepts, and clear up incorrect notions" (p. 82). That struck me because I feel that as a mathematics teacher, I am constantly trying to do just that. Flipped learning was presented in the research as a way for teachers to accomplish my goals of targeting instruction to students and being present with them in class while they develop their knowledge of the concepts. Thus, I felt it was important for me to utilize it in my curriculum.

Sammons (2009) described how guided math is a structure of teaching that has

many options for flexibility. There is still whole group lesson time, as in traditional math structures, that can be used for "presenting activating strategies…literature connections…[or] ongoing review of mastered concepts" (Sammons, 2009, p. 20). For this reason, I chose to incorporate eight fractions-based picture books to utilize during the whole group instruction (mini-lesson), because of the real-world connections that can be made between math and literature. Kroesbergen and Van Luit (2002) conducted a study of elementary math students in the Netherlands which discovered that students learn concrete mathematical skills more successfully with guided math instruction than other types of instruction. This intrigued me, and further convinced me to try guided math as the driving force in my curriculum. I wanted my curriculum to be something that teachers could use and adapt to fit the needs of any fifth grade class needing to achieve proficiency with fractions standards.

With the literacy curriculum in my district being so grounded in the ideals of guided reading, guided math seemed to be the most logical step to take. Additionally, as my district rolls out a technology initiative giving each student fourth grade or older an iPad mini for use at home and school, flipped learning was another good option. I was intrigued by what it might mean for students to have that kind of access to technology and how it would impact their learning.

The literature review was a vital part of this journey, because as teachers strive to find best practices for instruction, there needs to be careful consideration given to research. Finding various sources and synthesizing the information is an important skill to learn, and allows me to transfer that knowledge into my career. The most interesting

part to me now, looking back, is that in my current school we are doing full ability grouping. I considered my research when we made the decision as a team to do this model this year and I feel that trying yet another instructional method outside of the two I chose for this project has also fueled me with additional knowledge. The research inspired me to try things as a teacher, but the actual writing of the curriculum has helped me become a better evaluator of instructional practices.

## Possible Implications and Limitations

There is no perfect curriculum. There is no typical student or class of students. In considering this curriculum with an evaluative lens, it is important to remember that although this curriculum was created with a certain group of students in mind, that group will likely never experience the chance to learn it. Demographics of my school and district are always changing, as are district considerations for the way math is taught. There is no way for me to predict when I might get the chance to teach math in a fifth grade classroom again. However, I can consider some possible implications and limitations of this curriculum.

Possible implications for teachers using this curriculum. Because this curriculum was created with the students of the district in which I teach in mind, fifth grade teachers in my district would be able to easily implement this into their classrooms. Additionally, teachers in any district where school and home access to technology is abundant for students could also utilize this curriculum. In this technology-driven world, it is important to understand the impact it has on our students. By embracing the way our students prefer to interact and engage and infusing that into our instruction, student motivation and

achievement may increase. Having aspects of this curriculum that incorporate the district-issued iPad minis both at home and at school can help teachers do this.

Teachers who are familiar with the structure and format of guided reading (Fountas & Pinnell, 2009) will be able to adjust to the guided math structure of this curriculum rather quickly. Daily assessment, flexible grouping, and focused small group instruction are all positive attributes of this curriculum that allow for teachers to alter the curriculum as the students move through the concepts. The structure is a workshop that also gives time for students to work on mastering vital math concepts, such as basic fact fluency, which are not the specific focus of the unit. I chose to utilize games and websites for a station within the workshop where students are mastering their basic facts. I have found in my own classroom that students respond well to engagement with technology and the chance to interact with their peers. The activities I chose, such as Multiplication Headbands and working on www.xtramath.org, have boosted student achievement in my classroom. I felt it was important to include these activities in my curriculum. The basic structure of my daily lessons can be implemented within a heterogeneous or homogeneous ability classroom because regardless of scope or level, there are always varying abilities within a whole classroom of students.

The small group teaching allows for the students in all three ability groups to receive the targeted instruction that they need. It is important for the highest-achieving students to learn how to notice and name the strategies they use when working through math problems. This way, when these students do make errors, the teacher can see at what point things went wrong. The lowest-achieving students can benefit from daily

small group instruction because of the amount of time teachers can take with them focusing on foundational skills such as place value and basic operations, while also transferring knowledge of crucial vocabulary terms to help the students when working independently. Finally, the average students can truly be met where they are at in their ability, because though they always appear to be able to complete grade level work, this is often not the case. This group can benefit from the daily small group instruction because these students will get time with the teacher usually reserved in a traditional curriculum for the students at the lowest and highest ends of the spectrum. The teacher will be able to clearly see if in fact the students do understand the instruction, and intervene quickly when they do not.

Limitations of this curriculum. First, it should be reiterated that this curriculum is for future use and has not been implemented in a classroom setting. Therefore, as with any curriculum, it must be tailored to the specific group of students and adjusted as implementation occurs. The most glaring limitation of this curriculum is the heavy reliance on technology. At minimum, students must have a device available at home in order to complete the homework each night. In-school technology is necessary for individual students in at least one or two stations each day. Without the technology, significant changes would be needed for the math workshop, and the flipped learning aspect would be completely missing. Therefore, if access to technology is impossible, another curriculum will be necessary. This significantly limits the number of teachers who can utilize the curriculum described in this project, but as education continues to

change, access to technology will increase, and so will the number of people able to implement this structure.

As I consider this curriculum as a whole, I am pleased with the results. I look forward to being able to implement this in a classroom to see what areas need more expansion or revision. If I were to do this differently, I would have tried to do more with a few things. For example, I may have tried to include other math warm-ups to give more variety. One reason I did not was due to the structured nature of guided math and its reliance on routines being in place. The less time a teacher needs to spend on giving instructions for activities means more time is spent on learning. Another aspect I may have included is what to do in case of a technology emergency. One or two of the rotations in the workshop each day are dependent upon wireless access to the internet. What happens if this is unavailable? A plan would need to be in place to account for such events.

Future Research

As I continue on my professional journey, I feel it is important to continue to pursue additional research endeavors. I hope, in the near future, to be able to implement this curriculum in a real fifth grade classroom. It is only through implementation that I feel I will truly be able to evaluate the effectiveness, sequence, and structure of this curriculum. I also intend to continue to investigate professional research on best practice in mathematics instruction. Additionally, I would love the chance to return to my original project choice, which was investigating the effect of standards-based grading on literacy achievement. Conducting a true action research project is something I learned a lot about

during my time at Hamline, but something I have yet to complete on my own. Education is constantly evolving, and as an elementary teacher, it is vital that I stay up to date with the latest ideas, studies, and teaching practices. I look forward to having the opportunity to continue my post-graduate studies in other areas, such as more curriculum development or focusing on a specific group of learners like gifted and talented students.

## Summary of the Chapter

In this chapter, I reflected upon the project in which I answered the research question, *How can I design a math curriculum that will increase fifth grade students' understanding of fraction concepts?* I looked at the entirety of the capstone process that spanned the course of more than a year and the struggles I faced along the way. I revisited the literature review and how I came to the decision of creating a curriculum with flipped learning and guided math practices. I considered what implications this curriculum may have on teachers who choose to implement it and what limitations there may be in doing so. Finally, I discussed what may come next for me and my hopes for one day being able to implement my curriculum in an actual fifth grade classroom. While I have reached the end of this particular project, I know that I have just started my journey with professional research and curriculum creation. I look forward to continuing to grow in these areas throughout my time as an educator.

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# Appendix A

## Understanding by Design Curriculum Framework

**Fifth Grade Fractions Curriculum**

**Stage 1 - Desired Results**

**Established Goal(s):**

- **MN 5.1.1.1** Recognize that quotients can be represented in a variety of ways, including a whole number with a remainder, a fraction or mixed number, or a decimal.
- **MN 5.1.2.3** Order fractions and decimals, including mixed numbers and improper fractions, and locate on a number line.
- **MN 5.1.2.4** Recognize and generate equivalent decimals, fractions, mixed numbers and improper fractions in various contexts.
- **MN 5.1.3.1** Add and subtract decimals and fractions, using efficient and generalizable procedures, including standard algorithms.
- **MN 5.1.3.2** Model addition and subtraction of fractions and decimals using a variety of representations.
- **MN 5.1.3.3** Estimate sums and differences of decimals and fractions to assess the reasonableness of results.
- **MN 5.1.3.4** Solve real-world and mathematical problems requiring addition and subtraction of decimals, fractions and mixed numbers, including those involving measurement, geometry and data.

| **Understanding(s):** | **Essential Question(s):** |
|---|---|
| *Students will understand that . . .*<br>• The fraction bar is another symbol for division.<br>• A fraction is an actual number that represents a quantity.<br>• A quotient in a division problem can be represented as a fraction or decimal | • How are fractions part of everyday life?<br>• How would the world be different without fractions?<br>• How are fractions, decimals, and division related? |

| **Knowledge** | **Skill** |
|---|---|
| *Students will know . . .*<br>• How to estimate sums and differences of two fractions to check for reasonableness of results.<br>• How to utilize number lines and compatible numbers when comparing and ordering fractions.<br>• How to use multiples and common factors to assist with reducing, converting, and calculating fractions.<br>• How fractions are vital to certain occupations, activities, daily tasks, and other real-world situations. | *Students will be able to . . .*<br>• Add and subtract fractions with like and unlike denominators.<br>• Convert improper fractions to mixed numbers.<br>• Convert mixed numbers to improper fractions.<br>• Compare and order fractions, improper fractions, and mixed numbers from least to greatest or greatest to least.<br>• Calculate equivalent fractions.<br>• Reduce fractions to simplest form. |

**Stage 2 - Assessment Evidence**

| **Performance Task(s):** | **Other Evidence:** |
|---|---|
| • Fractions in Baking<br>• Fractions in Measurement<br>• Fractions at Home | • Daily exit slips<br>• Weekly quizzes<br>• Oral or written responses to Essential Questions<br>• Summative assessment |

**Stage 3 - Learning Plan**

**Learning Activities:**

Whole Group Read-Alouds

- *Fractions, Decimals, and Percents* by David Adler
- *Fractions = Trouble* by Claudia Mills
- *Funny and Fabulous Fraction Stories* by Dan Greenberg
- *Piece = Part = Portion* by Scott Gifford

- *Polar Bear Math* by Ann Whitehead Nagda
- *The Lion's Share* by Matthew McElligott
- *Working with Fractions* by David Adler
- *The Wishing Club* by Donna Jo Napoli

Flipped Learning Videos

- From Rebecca Gooding's website www.iflip4math.org
  - 9-3 Part 1: Convert mixed numbers to improper fractions
  - 9-3 Part 2: Convert improper fractions to mixed numbers
  - 9-4: Equivalent fractions
  - 9-5: Compare and order fractions and mixed numbers
  - 9-6: Common factors and greatest common factors
  - 9-7: Fractions in simplest form
  - 9-8 & 9-9: Convert between fractions and decimals
  - 10-1: Add and subtract fractions with like denominators
  - 10-2: Least common multiples
  - 10-3: Add fractions with unlike denominators
  - 10-4: Subtract fractions with unlike denominators
  - 10-5: Add mixed numbers
  - 10-6: Subtract mixed numbers
- From Brent Coley's website www.brentcoley.com
  - Adding and Subtracting Fractions
  - Rounding Fractions
  - Reducing Fractions
  - Converting Improper Fractions to Mixed Numbers, & Converting Mixed Numbers to Improper Fractions
  - Least Common Multiples & Comparing Fractions
  - Converting Fractions to Decimals & Decimals to Fractions
  - Factors & Greatest Common Factors

Guided Math Frameworks (from Laney Sammons)

- Math Warm-up
  - One activity each day, such as Number of the Day, "What's Next?" patterns, "How Did My Family Use Math Last Night?", "_____ Makes Me Think Of…" math connections, Data Collections, Problem of the Day, and Calendar Time.
- Mini-Lessons
  - Review of previous night's flipped learning video, vocabulary instruction, math read-aloud, directions for math workshop, etc.
- Math Workshop
  - Small group guided lessons

- Fact fluency (www.xtramath.org, Multiplication Headbands, Multiplication Roll 'em)
- Individual practice (www.ixl.com)

➢ Assessment

- Pre-assessments to determine strengths and needs
- Daily check-ins to inform instruction and structure small groups
- Summative tests on targeted concepts

# Appendix B

## Pre- and Post- Assessment

Name _____

# Fractions Assessment

1. Convert ¼ to a decimal. _____
2. Convert 0.375 to a fraction. _____
3. Convert $5\frac{1}{5}$ to a decimal. _____
4. Convert 3.25 to a fraction. _____
5. Convert 14/3 to a mixed number. _____
5. Convert 8/5 to a mixed number. _____
6. Convert $7\frac{5}{6}$ to an improper fraction. _____
7. Put the following amounts in order from least to greatest:
   7/12, ½, $3\frac{1}{3}$, 12/5, $1\frac{2}{5}$

   _____
8. List 3 different fraction amounts that are equivalent to 3/5.

   _____
9. Charlie walks to school each day. He always runs ½ of a mile, then walks 2/5 of a mile. How far does Charlie walk and run in all to school each day?

   _____

   _____
10. Lauren is $47\frac{2}{5}$ inches tall. Landon is $46\frac{4}{9}$ inches tall. How much taller is Lauren?

    _____

    _____

11. Gina and Kristina are having a pizza eating contest after school. Gina ate 3 1/4 pizzas. Kristina ate 3 2/10 pizzas. Who ate more pizza? How much more pizza did she eat? How much pizza did Gina and Kristina eat altogether?

_____

_____

12. Mr. Sell and Mr. Gilbertson are baking a cake. They need to double the recipe to make a larger cake to feed more people. Mr. Sell says that if they are doubling the recipe, they should change 1/4 cup of oil to 1/2 cup of oil. Mr. Gilbertson disagrees and says if they double 1/4 cup of oil, it should be 2/8 cup. Which teacher is correct? Why?

_____

_____

13. Write the following fractions in simplest form.

3/12 = _____ 5/30 = _____ 4/100 = _____

14. Compare each amount. Write <, >, or = in between each pair.

5/12 _____ 1/2 7/8 _____ 14/16 3/9 _____ 2/3

12/8 _____ 3/2 11/4 _____ 9/5 7/3 _____12/10

2 1/2 _____ 2 1/3 3 4/9 _____ 3 4/5 1 3/8 _____ 1 6/16

# Appendix C

## Fraction Quizzes

Name _____

# Fractions Quiz 1

Convert the improper fractions to mixed numbers.

1. 37/4 = _____ 2. 23/5 = _____ 3. 17/6 = _____

Convert the mixed numbers to improper fractions.

4. 3 1/3 = _____ 5. 2 5/8 = _____ 6. 4 7/10 = _____

Name _____

# Fractions Quiz 2

Write <, >, or =, between each pair of fractions.

1. 2/3 _____ 4/6 2. 5/8 _____ 3/4 3. 1/2 _____ 4/10

Put the following fractions in order from least to greatest.

1/2, 1/3, 8/9, 7/12, ¼

_____

Put the following fractions in order from greatest to least.

5 ½, 2 ¾, 9/2, 7/3, 1/6

_____

Name _____

# Fractions Quiz 3

Reduce the following fractions to simplest form:

1. 8/12 = _____
2. 6/10 = _____
3. 12/16 = _____
4. 5/25 = _____
5. 7/21 = _____

Name _____

# Fractions Quiz 4

Write <, >, or =, between each pair of numbers.

1. 1/2 _____ 0.500
2. 3/4 _____ 0.34
3. 5/6 _____ 0.56

Convert between fractions and decimals. Write fractions in simplest form.

4. 0.125 = _____
5. 0.75 = _____
6. 2/5 = _____

Name _____

# Fractions Quiz 5

Add or subtract. Write each answer in simplest form.

1. 3/4 + 1/2 = _____
2. 3/8 + 2/3 = _____
3. 1/5 + 1/6 = _____

4. Rowan ate 2/9 of a pepperoni pizza. Jake ate 1/3 of a sausage pizza. Who ate more pizza? How much more pizza did that person eat than the other person?

   _____

5. Anna walked 1/3 mile on Monday, 3/5 mile on Tuesday, and 1/4 mile on Wednesday. How many miles did she walk in all?

   _____

6. Andre and Yoni had to read a book for their research project. Andre read 5/12 of the book, while Yoni read 2/3 of the book. Who read more of the book? How do you know?

   _____

Name _____

# Fractions Quiz 6

Add or subtract. Write each answer in simplest form.

1. $7\ 1/4 + 2\ 3/4$ = _____
2. $4\ 1/3 + 3\ 3/8$ = _____

3. $3\ 1/4 - 1\ 3/4$ = _____
4. $5\ 2/3 - 1\ 3/4$ = _____

5. Ramira filled $4\ 1/8$ grocery bags full of food to donate to the food shelf. Sydney filled $3\ ½$ grocery bags. How many grocery bags did they donate in all?

   _____

# Appendix D

## Number of the Day Form

NUMBER OF THE DAY: _____

EXPANDED FORM

WORD FORM

ROUND TO THE NEAREST:

TEN

HUNDREDTH

THOUSAND

1,000 MORE

1,000 LESS

0.0001 MORE

0.0001 LESS

CREATE A WORD PROBLEM USING THE NUMBER: